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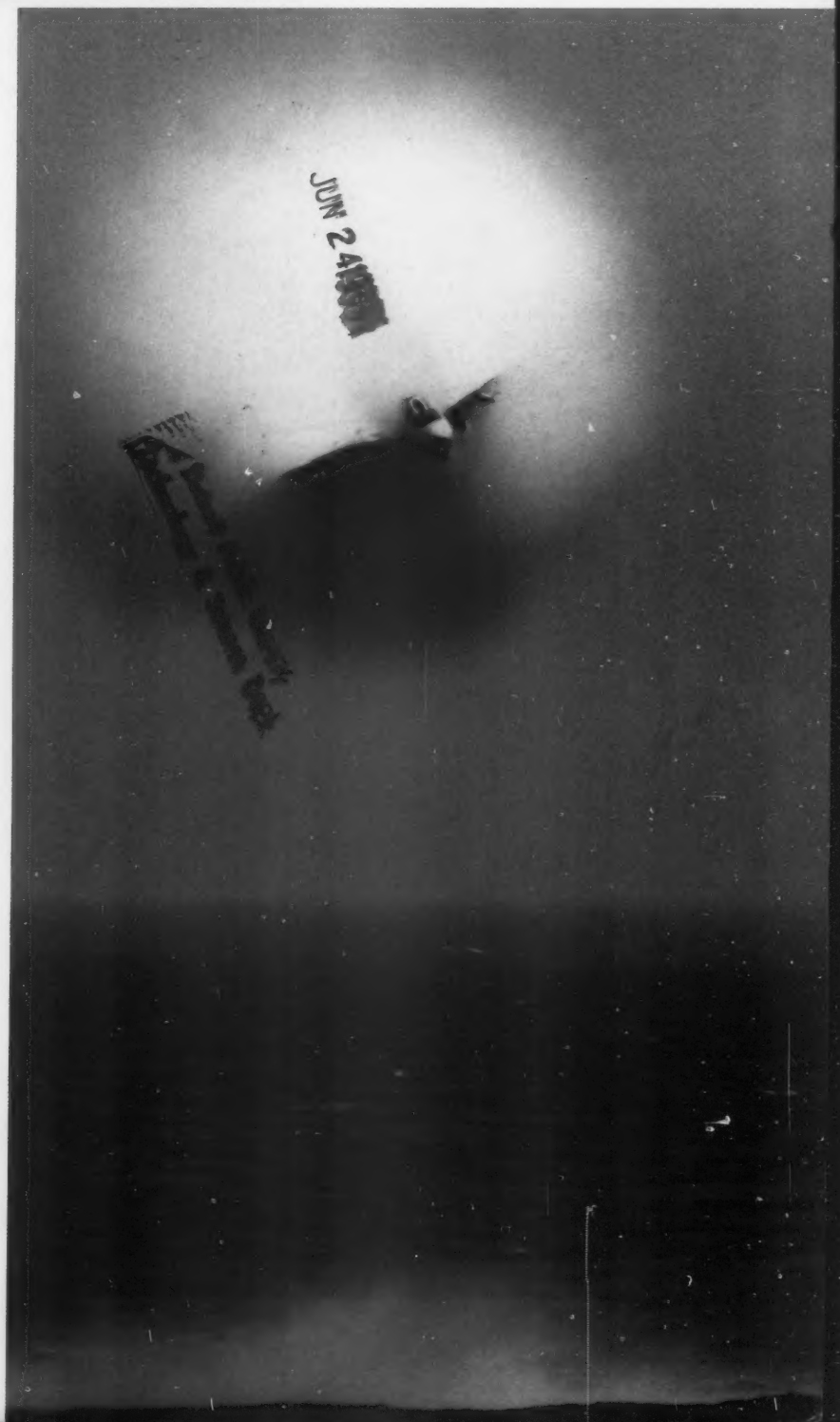
approach looks at low-level flying


JUN 24

A condensation 'cloud' surrounds a VF 143 Tomcat as the aircraft passes through the speed of sound. The shock wave can be seen on the water's surface.

"Altitude, Altitude"

By Lt. Mike Buzzell

YOU just finished the brief for another night SSC mission. It's four months into cruise, and you're starting to feel comfortable with the carrier environment and a little surprised how little time it took to go over the mission specifics, especially since we just left port two days ago. As a single-seat aviator, you're confident that this airborne respot will be just another hour and a half of boredom, except for the last 30 seconds. As usual, that will require total concentration for that OK 3.

You cat off and climb to 5K. Weather is marginal with broken layers, low visibility and light rain. A little disorienting but no problem; you have been there before.

A contact call from the E-2 vectors you north. You have a good radar lock, so you decide to descend to 2K to get out of the goo and use the FLIR. Arriving at 2K, you're still in the soup, so you run your radalt down to .9K and descend to angels 1K. No problem — you have done this before on a night war at sea, and you can hack it! At 1K, the visibility is pretty good with only a few scattered clouds. As you make your first run on the contact, you work hard to get good FLIR video. Approaching the contact, you're concentrating hard, looking to get that perfect FLIR picture so you can brag in the ready room tonight. Right on altitude, the first run goes smoothly and you turn back to reacquire. As you turn back, you look over your shoulder to pick up the ship's lights to help you get lined up for the next run. The next sound is the radar altimeter tone crying out the alarm!

Then, the silence.

How many times must we relearn this lesson? At night, single-seat or dual, you are in one of the most demanding of all flying environments. It requires extreme concentration and caution. Low-altitude missions claim the lives of even the most skilled pilots. Is it possible that the danger of the night SSC mission is never discussed or even mentioned in the standard night brief? Are there minimum altitudes set by your air wing or squadron SOP? Are you, as the pilot, current enough to execute the surface search at minimum altitude; or was your last night trap two weeks ago? These are just a few questions that you must answer *before* you leave the ready room, or the grim reaper could knock at your door.

"Altitude, altitude" — lack of it can get you killed in the night carrier environment or anywhere else you fly. A healthy respect for the inherent dangers of flying low, day or night, will keep you around to a ripe old age. Know your capabilities and the importance of the mission before you give yourself bad odds on the bet of your life. An old carrier group commander once told me three rules:

- Fly smart.
- Fly half scared.
- Always leave yourself an out.

Sounds like good gouge to me.

Lt. Buzzell is an LSO and QAO with VFA 137 in USS *Coral Sea*.

From 1982 through 1987 the Navy and Marine Corps lost 98 aircraft during low-level flights. The cause of most of the mishaps is like that story told above: preoccupation with some task that led to controlled flight into the ground or water. Virtually no community has been immune from this type of mishap; the A-6 leads the pack. In some instances, investigators have found the radar altimeter turned off.

If you're flying at low-level, make sure altitude awareness is a large part of your situational awareness. Any time you allow something else to preoccupy your attention, you're setting yourself up for the big one.

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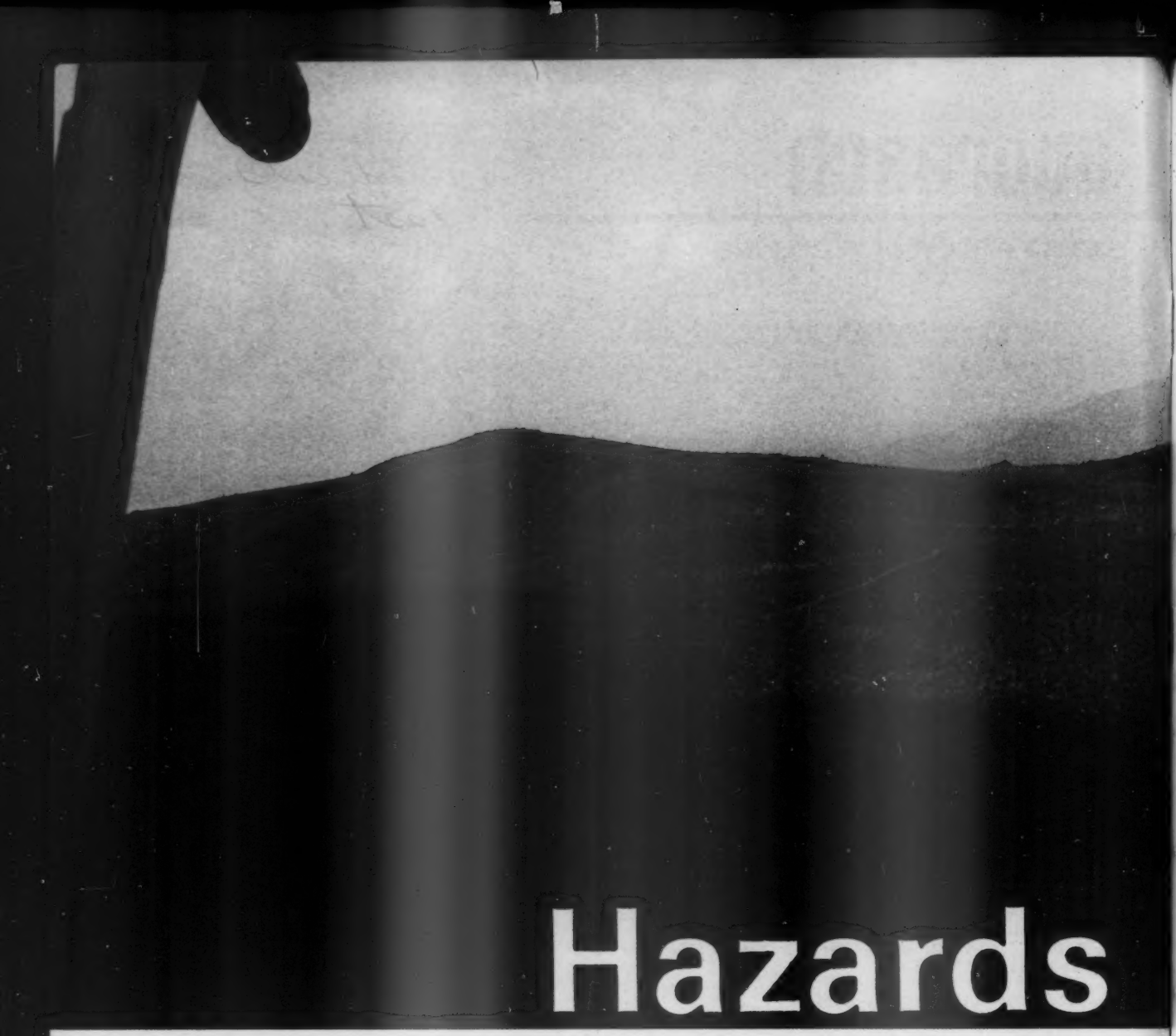


Hazards of Flying Low-Level

By Col. Grant B. McNaughtton, (MC), USAF

Don't get sucked in.

LOW-LEVEL flight imposes significant demands on the pilot and considerably reduces his margin for error. The low-level arena is a treacherous environment; since the end of the Vietnam war, it has claimed over 150 aircraft and more than 350 lives. There are several facets of this treachery. They include anomalies of perception, attention, judgment, knowledge and discipline. This article will focus on anomalies of perception or vision.

Vision

While vision is the most important of our perceptual senses when flying, it is not completely foolproof. Its failures stem from non-perception, height/distance misestimations and focus trapping, all of which tend to get us closer to the ground than we may have realized. In addition, some recent research indicates that the apparent size of images can change as a function of the distance to which the eye is focused. Vision can also be impaired by sun glare or by high G, and misperceptions may result from aircraft design. *The bottom line on perception is you can't always trust it — it can sucker you lower than you think.* For details, read on.

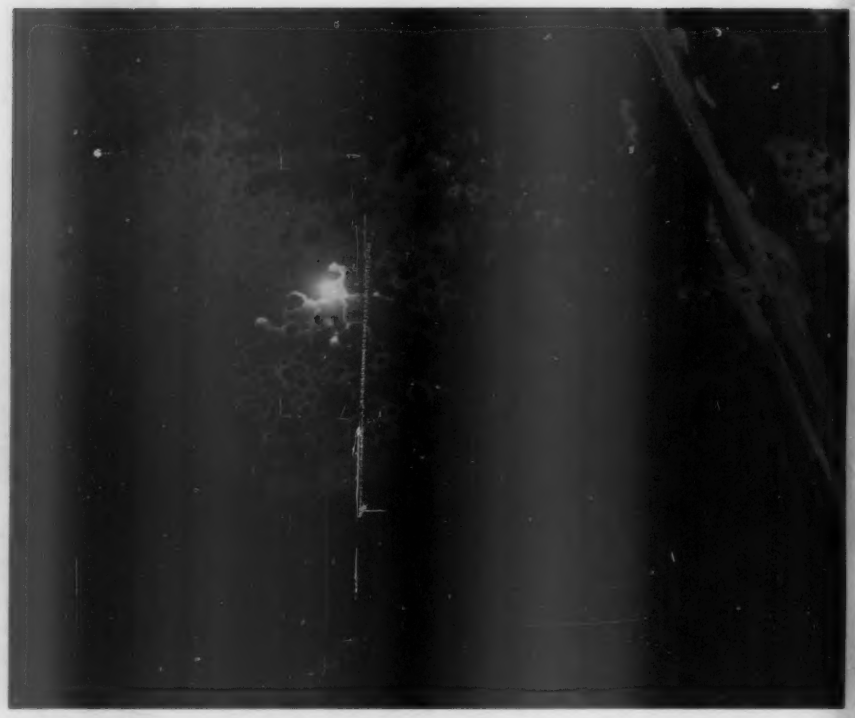
Non-perception is failure to see an object that blends into its background due to similarity of texture, coloring or lack of contrast. Such foreground masking is enhanced by lighting conditions that reduce or eliminate shadows, as with a high sun angle, beneath an overcast or in haze. Terrain with insidious elevation changes is particularly deceiving. Rolling forests and deserts with their subtle upslopes and propensity for disguising high ground are big players in collisions with the ground. Deserts camouflage their obstructions masterfully.

Camouflaging applies not only to the ground and ground objects, but to vegetation and man-made structures as well. The hazard of leafless deciduous or dead trees jutting above the foliage that masks them is well-known. Power lines and high towers are constant threats.

Height and Distance Estimation

The ability to gauge height and distance is a natural endowment. It must be learned and relearned every time a pilot checks out an unfamiliar area. Height and distance estimation involves one or more of the following factors: perspective, definition and motion-related sensations.

Perspective is the gauging of distance by the relative size of some object of known dimension. Confusing the size of the "known" object(s) by which perspective is gained creates a dangerous trap. For example, pilots accustomed to flying over ranges with tall trees or large rocks may be suckered down too low over ranges pep-



pered with short trees and pebbles. A low sun angle can produce long shadows from short trees and create the same trap. Switching from a range where the brush is several feet high to a range where it is only 1 foot high requires a quick recalibration of the visual system.

The type of terrain influences perspective: The less the perspective, the less the ability to gauge height. Height estimation may be impossible over relatively flat and featureless surfaces such as water, snow, dry lake bed or desert.

A perspective misjudgment nearly killed one crew member. As the helicopter in which he was a passenger was approaching for a landing, he saw what he thought was a paper cup bouncing along the runway; he unstrapped and prepared to jump out. In fact, the cup was a king-sized fried chicken carton, and the chopper was still 30 feet in the air.

Fine definition of clarity conveys closeness, whereas anything which reduces definition conveys a false impression of distance (or height), such as haze, dust, fog, twilight, blowing snow or drizzle. Low-level and poor visibility constitute an unhealthy combination.

Motion parallax, the relative motion of near objects to those distant, is a function of ground speed as well as height. It's a useful height gauge as long as the terrain surface presents some definition. Watch out over calm water, dry lake bed or snow.

Peripheral visual speed blur results from a combination of speed and terrain proximity that exceeds the fixating capacity of the eyes. Occasionally, a rearward flick of the eyes will fixate an object for an instant amid the blur, causing a "stop action" or "stroboscopic flash" sensation. These sensations mean that you're low, probably below 30-50 feet.

Engulfment sensation, or a sensation of being swallowed up, may occur over certain surfaces such as water or dry lake bed under combinations of enough sink rate to register as such in the peripheral visual fields and close proximity to the surface. It means you're just about there.

Focus-trapping

Each of us has a relaxed accommodation distance known as the dark focus, the distance to which our eyes accommodate or focus if not looking at something other than empty sky, night or weather. For the emmetrope (person with normal or 20/20 vision), this distance averages about three feet. For the myope (Mr. Magoo types), it is shorter, and for the hyperopes (eagle-eyed peepers), it's longer — in fact, may be extremely long.

Any visual stimulus that coincides with the dark focus traps the focus and degrades acuity beyond. You can check this for yourself with a window screen. Take something you can read at 30 feet and place it about 20 feet beyond the screen. Move backwards from the screen and note whether it tends to go out of focus at a certain distance, and if moving farther backwards, tends to bring it back into focus. If so, that out-of-focus distance is a rough measure of your own dark focus. Should it coincide with your distance between your eye and your aircraft windscreen, anticipate that any visual stimulus on the windscreen such as dirt, moisture, oil smear, crazing,

Once a visual misrepresentation lures an unwary pilot closer to the ground than he intends to be, he is a setup for a ground-kill.

sunglare, reflection or bug-splatter may trap your focus and degrade your visual acuity for objects beyond the windscreen.

Another consequence of the dark focus is apparent changes in the size of images. Research done in this area indicates that when one accommodates far, images enlarge, and when one accommodates near, they shrink. The apparent size change can be as much as a factor of 1.5 in persons with a long dark focal length. One practical aspect of this phenomenon is that if you accommodate near due to focus-trapping, objects beyond may shrink somewhat and thus appear farther away than they really are. If things appear smaller, you tend to fly closer.

Sun Glare

Sun glare and the resulting after-image can impair visual acuity for several seconds — long enough to set up a mishap.

Aircraft Design

The nose of the aircraft provides the pilot an important reference by which to gauge attitude or to detect subtle changes in attitude, both in pitch and in yaw. Some airplanes, the A-10 is one example, deny the pilot this reference, permitting inadvertent, undesirable attitudes.

Once a visual misperception lures an unwary pilot closer to the ground than he intends to be, he is a setup for a ground-kill. All it takes is a moment's inattention to the velocity vector, although it can also happen to the guy who is perfectly attentive to his flight path.

Vision is the most important sensory input you have; and yet, in the low-level arena, you can't trust it 100 percent. That's one good reason for those minimum altitudes. Recognize that it is easier to get lower than you think and recalibrate your judgment accordingly. ●

Reprinted from: Flying Safety, August 1986 issue.

The

IT seems all nugget pilots have pondered the same questions at some point in their young careers: In a rapidly deteriorating situation, would I eject? Would I stay with it? Are my actions justified?

Most aviators will never get to answer these questions. Unfortunately, I found myself smack in the middle of it on my first cruise and got to answer all of those questions.

It started out as just another Indian Ocean borex. Our flight was a planned 1.5-hour hop. The mission was to conduct several jamming runs on the battle groups. Due to the short cycle and full load of gas that the aircraft had, it was apparent we were going to have the luxury of making some speed, with a little extra go juice in the tanks for the recovery.

The first half-hour of the flight was uneventful as we made several jamming runs in our EA-6B at high to medium altitudes. With about 20 minutes to go before the recovery, we did a low-altitude, high-airspeed jamming run on the CV. Dropping down to 200 feet and accelerating to 500 KIAS, we proceeded inbound. I recall setting the radar altimeter at 180 feet and throttling back a bit, to remain at 500 KIAS. At one point we were up around 510 to 520 KIAS, but I felt a bit better staying at 500 (the EA-6B is limited to 550 KIAS at low altitude when carrying pods).

Approaching 20 miles with wings level, we experienced a massive explosion and severe airframe vibrations. My initial reaction was to pull up and get away from the water as quickly as possible. The cockpit was full of smoke (later determined to be air conditioning vapor). A quick scan of engine instruments revealed that both engines were working and we were not on fire. The only thing that kept me from jettisoning the aircraft, in fact, was the lack of fire warning lights illuminating my petrified face. After 30 seconds or so, we determined that the

e Radome's Gone!

By Lt. Rick Dubois

airplane was still flying, and now it was merely a matter of determining what we had left and coming up with a game plan for getting the beast back aboard ship.

Leveling off from our zoom climb, we quickly determined that the angle of attack, pressure altimeter and airspeed indicator were inoperative. Peering out the windscreen, we noted that the radome was no longer with us, and the parts that did remain were violently flapping in the breeze. My initial reaction was, of course, "Boy, the skipper's going to be mad when he sees what I've done." My secondary reaction was trying to figure out what had happened. We were over 500 miles from the nearest land, and we had not spotted any birds. Our 200-foot altitude ruled out the possibility of a flying fish. That left me with one option: I was going too fast. But that wasn't the case because we were 50 KIAS below redline.

Breaking out the damaged aircraft checklist, we discovered, among other things, that we should climb to 10,000 feet and slow flight the airplane. That presented two immediate problems. Number 1, we had two severely FODed engines, and I didn't feel comfortable using them to get up to 10,000 feet. Number 2, I had no airspeed or angle of attack; and in order to drop the gear, I had to guess when I was below 250 KIAS. After making several frantic calls to the boss for a ready deck, we calmed down a bit and realized we could get our groundspeed off the INS. We did a hasty controllability check while circling above the ship, and we started a gentle descent for the visual straight in. Arriving a couple of miles behind the ship, we used the radar altimeter for a rough altitude setup and the groundspeed and trim setting for proper attitude. The approach and trap went according to plan, although I must admit it was the worst OK 4-wire I have ever earned.

Judging by the looks and reactions on the faces of the yellow shirts, I could tell immediately that the damage was worse than I had suspected. The postflight inspection revealed that the nose radome had completely departed, and the only part remaining was about 4 inches of the attachment ring. The radar and radar pedestal also broke off, and only a rough bunch of parts remained. Both engines were FODed, and huge pieces of fiberglas radome adorned the intakes. The fuselage was perforated in several places and the starboard slat severly dented. Two jamming pods were slightly damaged, and every single pitot tube, AOA transmitter and temperature probe was bent or gone.

Weeks after the mishap, there were several things that we had learned. The mishap was caused by a reworked radome that should not have been in the supply system. Reaching 500 KIAS, it simply failed and imploded. As a crew, we realized that we had never communicated directly with the two back seaters. We were so busy in our own little world up front that we had neglected to really take the time to explain to them what had happened. They were forced to sit through the commotion and hang in there. I have to commend them for not punching out and then sitting there silently, allowing us to take care of the business at hand.

Lessons learned: First, communicate with the entire crew, and don't take it for granted that they will figure out what is going on just by listening in on the front-seat ICS conversation.

Second, know your airplane. Know its capabilities and its limitations. When you have critical information taken away from you (such as airspeed or AOA), know where to look to get some of that information back (trim setting, groundspeed, etc.). Although you can play "what if" forever, you need to really think about the aircraft systems and have a good understanding of how everything is interrelated.

The last lesson I learned was the fact that, put into a rapidly deteriorating situation, you really do have a bit of time to analyze, think and come up with a correct course of action. I clearly recall staring at the fire warning lights and deciding at that point that we weren't going to have to eject. I was later amazed at how well I could remember things like throttling back down to 500 KIAS, setting the radar altimeter at 180 feet and flying at 200 (while the pressure altimeter read 325), little details that were somehow imprinted in my memory.

Unfortunately, we were put in a situation where we got to answer all of the questions. Luckily, things worked out well; and we were all able to learn some valuable lessons that will come in handy, no doubt, next time we find ourselves asking those very same questions. ●

Lt. Dubois flies EA-6Bs and is aircraft division officer for VAQ 137.

The Ground Still Has a Pk of 1.0

By Cdr. John Schork

"THE aircraft impacted ground." "Ejection sequence interrupted by ground impact." "Aircraft impacted the ridge." "Fatal injuries sustained during ground impact." The litany goes on and on, never failing to chill the heart of all aviators. Yet we continue to fly into the ground. We do it at night and during the day. We do it on low-levels, at the target, behind the ship. We do it wherever we fly. What is the problem?

The Arizona Air National Guard did a superb low-level ground avoidance study a few years ago. They managed to classify the low-level hazards we face, such as visual miscues, aerodynamic limitations and time/space/maneuvering criteria. The rules they published are a great gouge for day VMC low-level flying and surviving. But in the current world of attack aviation, we need to expand our flight guidelines to cover night or IMC ops.

Sophisticated defense systems will often require high-speed night ingress and egress. The most important requirement for safe, combat effective, low-level flying is situational awareness. Lose that awareness and you can die. Maintain that awareness and targets get destroyed. We recently asked our squadron air crews to tell about the time they "almost flew into the ground." The common thread was a loss of situational awareness. For whatever

The old axiom "aviate, navigate, communicate" was swell for T-34s at Whiting. However, we need to modify it for state-of-the-art, low-level operations.

reason, these crews failed to maintain correct priorities while operating close to the ground. Here are a few excerpts:

"Then I realized I turned into the wrong valley . . ."

"As we initiated a hard climb, our radar altimeter bottomed out at 100 feet."

". . . became distracted and disregarded the LAWS tone — pulled up as the rad alt went through 50 feet."

". . . lost track of timing problem and thought the next ridge was 1,000 feet lower than it really was."

There has been a lot of message traffic and discussion about the last few mishaps and one near-miss the Navy A-6 community has experienced. The common thread has been a preoccupation with mission objectives. Whether it was a COMPEX run or a run into a strange target, or the pressure to put the bomb on target on the first run, the crew failed to maintain adequate separation from terra firma. There have been valuable lessons learned from these incidents. These lessons include a reemphasis on use of the radar altimeter, redesign of cockpit instruments to cut down crew distraction, and the importance of having a pre-briefed low-level game plan. But there is also a need to redefine low-level priorities in the current world.

The old axiom "aviate, navigate, communicate" was swell for T-34s at Whiting. However, we need to modify it for state-of-the-art, low-level operations. The situation can still be broken down into three areas of priority.

Vertical Navigation. The ground has a P_k of 1.0. Failure to maintain adequate clearance will invariably terminate the mission, aircraft and yourself in that order and very quickly. In the regimes we must operate in, ground clearance must always be at the forefront of our scan and attention. When you're close to the ground, traveling fast, at night or in bad weather, maneuvering to hit a target, there is nothing more important than the vertical clearance of your aircraft. Emergency safe altitudes that will accommodate all navigation errors must always be in the crew's mind. *Total* reliance on electronic equipment cannot be accepted nor can ignoring systems and relying on seat-of-the-pants. Improved systems for ground avoidance and vertical navigation are critical to mission accomplishment. But in the end the crew must maintain an awareness of their position in space, always ready for an electronic malfunction. The most modern surface to air systems still cannot compete with the ground when it comes to killing aircraft. When in doubt, climb.

Horizontal Navigation. Failure to maintain your correct planned path to the target does several things. It poses a hazard to your vertical navigation situation, particularly in mountainous terrain. It provides you with an unplanned tour of enemy defenses you really didn't want or need. And it makes it highly unlikely your ordnance will reach its intended destination. The time criticality associated with vertical navigation is not quite as pressing in horizontal navigation, but can be very close in order of importance. The need for emergency safe altitude is paramount, as is a constant awareness of the current terrain elevation. Reliance on visual cues to ascertain your altitude AGL is a path to disaster. Proper preflight route planning and execution will lay the groundwork for an effective attack.

Weapon System Employment. Once you have mastered priorities No. 1 and No. 2, you can now concentrate on using all your gadgets, scopes and computers to wreck devastation in pursuit of national, tactical or personal goals. However, even during the attack run itself, failure to keep vertical navigation in your scan can result in a much larger crater than you expected. The advent of higher technology weapons and systems has actually increased the danger to the crew during the actual attack phase. The day VMC gunsight attack simply did not task crews like laser-guided bombs, radar-delivered ordnance or standoff weapons.

Nothing new and startling here, if you need a catchy phrase: "elevate, navigate, devastate." But we must reinstill in our crews what their priorities are when they are down low, going fast, at night or in the goo. There is no reason for modern, high technology aircraft to impact the ground; the systems and backups are too good. We need to make sure the people operating them are as good as the systems they are flying. When in doubt, elevate!

Cdr. Schork is a bombardier/navigator in VA 95. Previous tours included VA 95, VA 128 and VA 165.

The Hop Was Perfect . . . Except for the Midair

By Lt. K.C. Hutcheson

WHAT a great day to go flying! It was a beautiful Sunday afternoon in southern California. My trusty Corsair and I were returning home from a good cross-country weekend. Fightertown base ops was accommodating as usual. Being an infamous cross-country pilot, I began checking every preflight planning block.

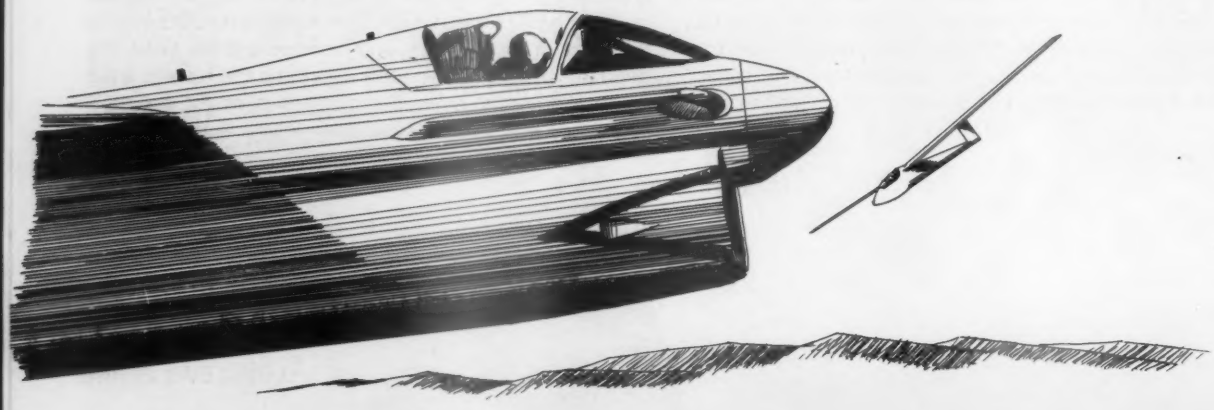
I planned to fly a local low-level training route that would take me on a scenic tour of southern California, then fly back home. This had all the makings of a great hop — great weather, great airplane, great countryside and flight time. The preflight, man-up and takeoff confirmed my expectations, and the Flight Service Station even answered my call when I checked in on the first point of the route, a rare occurrence at best. It was, in fact, a beautiful day, hardly a cloud in the sky. I was thoroughly enjoying myself as I approached my next to last check point. The point was a mountain peak with a ranger tower on it, and as I arrived, I made a left turn to the last leg of the route. As I was rolling out I saw him — a glider just on the other side of the ridge. He was pointed straight toward me as I was rounding the peak.

A few seconds after spotting me, he must have realized that my turn put us on a collision course and that I couldn't see him in his small cross-section sailplane. He dropped his nose and right wing to show me some planform and to try to get away.

My entire body was filled with terror when I saw nothing but glider in my windscreen as I pulled back on the stick while screaming into my mask. It was only a moment before we collided, but I found it was plenty of time to ponder my autobiography from birth to my sudden new interest in purchasing some rural real estate. I thought I was in the archives for a second there, and my dreamy Sunday afternoon had violently become a nightmare.

The next few moments were filled shouting every expletive known to mankind until I realized that I had actually survived a head-on midair and my combat-proven Corsair was still flying. I knew that I hit the left wing of the glider but wasn't exactly sure where he contacted my aircraft. My new vibrations felt and sounded like airframe vibrations, and I thought that perhaps I had pulled up enough to only get a glancing blow to the bottom of the Corsair. My mind was filled with visions of the glider pilot and what happened to his frail aircraft. I looked over my shoulder for him but saw nothing. I thought the impact certainly must have ripped his wing off at the root and he was spiraling down into the mountainside. We're talking some high anxiety here!

I figured there was nothing I could do for him now anyway, so I started climbing toward Miramar only 30-40 miles away. I finally began to settle down and told Approach what happened. I reviewed the structural damage part of the NATOPS Pocket Checklist to make sure I wasn't forgetting anything as I proceeded overhead for my dirty-up and controllability checks. A visual check by an airborne Tomcat confirmed that my control surfaces weren't damaged and the Corsair was controllable in the landing configuration. I hadn't experienced any engine



instrument fluctuations, but when I added some power to stop my deceleration, the engine sounded like a box of rocks, shaken vigorously. Good deal. I made a precautionary approach to a field arrestment.

Upon shutdown, the engine made all sorts of clickety-clackity noises, and when I climbed out of the cockpit, I could then see where the glider had hit. There was a jagged hole about the size of a football in the intake with fiberglass wing fiber packed in it. You could also see white scraped paint streaks swirling down the intake and visible FOD to the first stage blades. The tailpipe still had bits of fiberglass from the glider wing in it. A runner from base ops came out to tell me that the FAA called, and, although losing 3 feet of his wing, the glider pilot had landed safely.

Once again the big sky-little airplane theory had been disproven. Anyone who has flown airplanes for any significant length of time has had a close call with another aircraft, or *will* have one. I have around 1,200 jet hours, and this was the third time I have seen a small civilian aircraft without enough time to avoid it. Fortunately, the other times I wasn't that close, and it just surprised me.

The amount of VFR traffic in the United States is becoming enormous, especially in the southern California area. Two gliders or two light aircraft flying at VFR altitudes are not too bad, but throw in a military jet on a training route at 400 plus knots, and you have a serious problem. Jets at that speed are incapable of "seeing and avoiding" small cross-section targets, especially if they have no crossing angles. Civilian pilots must become educated on the danger to *them* of military training routes and where they are and how to find out if they are active or not.

This incident has reinforced another point to me that I have already learned and generally live by, and that is preflight planning. On many occasions I have found myself walking to an aircraft realizing that there were a couple more things I could have done to better prepare. Fortunately, for me, that wasn't the case on this flight. I had made all the appropriate calls to schedule the route and read all route restrictions. Even as prepared as I was to go on a simple hop on a beautiful day, near disaster struck. All that preflight planning had absolutely no effect on the collision itself, but imagine if I had been violating a published restriction due to ignorance and an unprofessional approach to preflight planning. That would have made standing in front of the big green table and answering very painful and not too career-enhancing questions. Even something unrelated to an actual mishap will come out in an investigation, and the finger will be pointed at you if your performance has been less than acceptable.

Everytime you man up, you should be convinced that you have "checked all the blocks" in your preflight planning. If your hop should turn into a nightmare through no fault of your own, you will avoid a lot of heat. Most importantly, it's the best way to stack the safety odds in your favor. ●

Lt. Hutcheson flies A-7Es with VA 27.

And for the glider pilot's viewpoint, we offer his story.

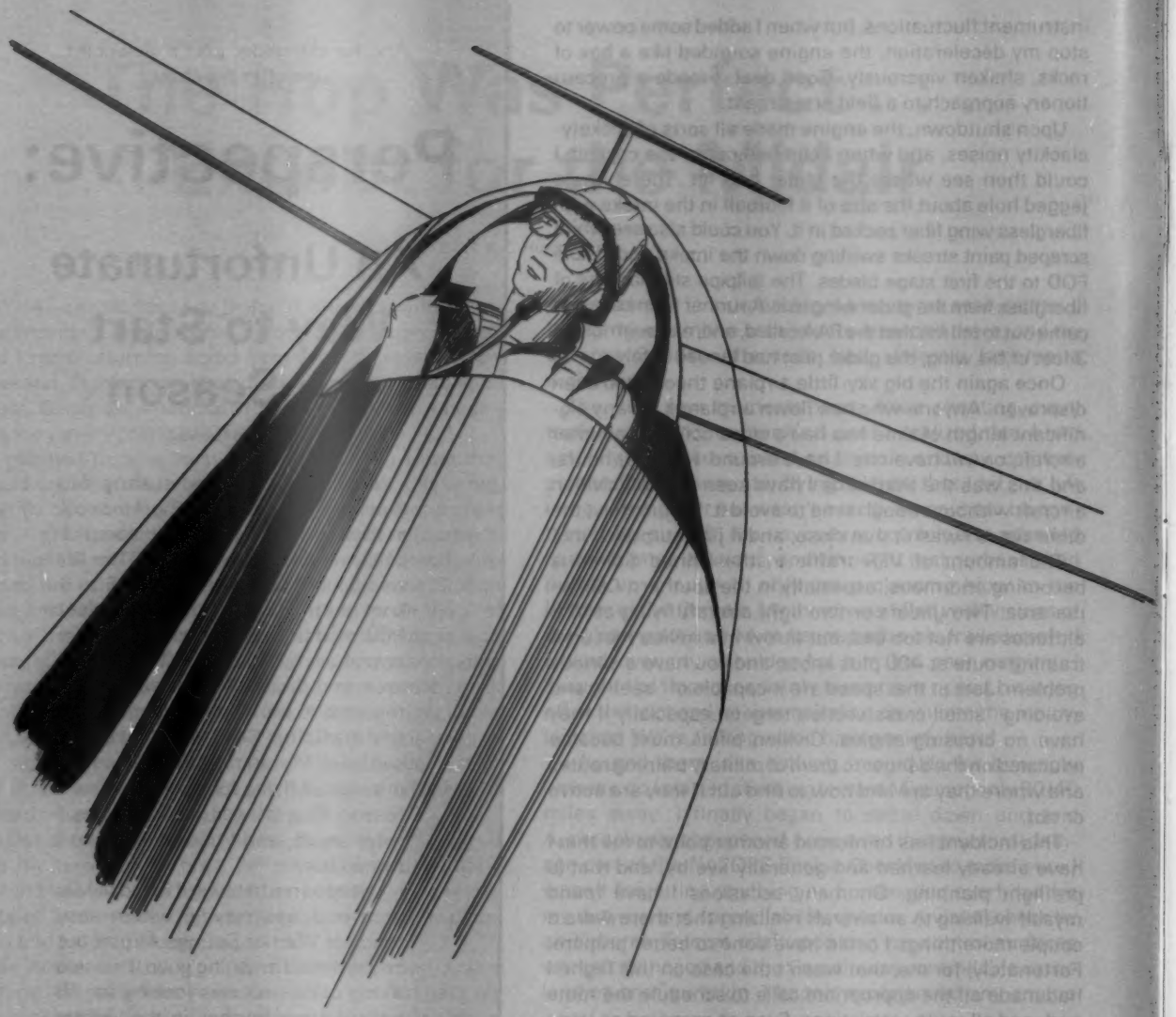
Perspective:

An Unfortunate Way to Start the Season

By Chip Garner

IT was the first good soaring day that I had found last Spring. I took off at Hemet-Ryan airport at about 1 p.m. and headed southeast. The lift was good; I was able to work 5 to 6 knot thermals to about 9,000 feet MSL over the mountains. The terrain is at about 5,000 to 7,000 feet in this area and drops off spectacularly to the east to the Anza-Borego Desert and the Salton Sea at 235 feet below sea level. My radio quit after about 45 minutes of flying for some unknown reason. The lift was weakening as I went south, and I had no crew so I turned back.

I headed north toward the Idyllwild area and was staying within easy reach of Warner Springs Airport but couldn't find anything good. I mosied along north and was looking for lift near Warner Springs in the vicinity of, and about level with, the lookout tower five miles east of the airport. I was flying into a canyon when I saw a military jet come over the ridge headed on a long radius arcing turn that would obviously intersect with me. I initiated a right turn and started nosing down, but the jet was coming on very fast. I did not want to bank too far because I was very aware that banking would increase my collision cross section as well as my visual cross section from the jet, so I compromised and banked somewhat. I kept hoping that the jet would straighten out and miss me by several hundred feet or more, but this opportunity was



disappearing with astonishing speed. I thought I was going to go through the large circular object under his left wing, which I thought was an engine and later learned was a drop-tank. At about this time the jet pilot apparently saw me and pulled up. I continued to push down and started to bring the left wing down (I had banked right to turn away) so it would clear the jet. It looked like we would just clear, and I thought I would probably have to report the near-miss.

About one to two seconds after the jet pulled up, there was a loud bang and the glider shook, but did not yaw, as he went by. My radio came back to life, and there was dust flying around in my cockpit. I thought the loud bang had been from his wake at such close quarters, but I immediately looked out and saw damage to my left wing. I then looked down and felt some discomfort at the thought of bailing out (I was at about 800 feet over steeply rising terrain) and initiated a left turn toward Warner Springs Airport and toward more ground clearance. The ship turned nicely, which was very pleasing and led me to think that the damage must be minor. I was relieved not to see any crashed jet aircraft in the valley.

Of course, I hit a great thermal a mile or so on the way toward Warner Springs Airport. I started climbing and announced my predicatment on the radio, which caused a lot of commotion. I started thinking about soaring the 40 miles back to Hemet as I got higher (I was within final glide for a 15-meter LS-4) and began wondering how to estimate my L/D. I got some good advice on the radio. Curt Hawkins in sailplane side number CJ and others pointed out politely that flying back to Hemet in a damaged glider when Warner Springs was in easy reach was a dumb idea, and offered to come get me. Jack Gravance in HL suggested that I check

In retrospect, the best thing I could have done when I saw the A-7 would have been to bank away to show him as much wing area as possible and to hope he saw me in time.

my dive brakes, gear, slow flight and control travel while I had altitude. Bob Backer in 3S came in below me in the thermal and reported that I had lost about a meter of my left wing and that there was a piece hanging down.

I climbed a while and then flew a mile or two further out into the valley and tried slow flight, faster flight, gear, dive brakes and turns in both directions. I then dumped my altitude and entered a left-hand pattern for the west-facing runway at Warner Springs. Flying the pattern I noticed a large loss of L/D. I got scared as my options narrowed on approach (I hadn't had time to get scared earlier), but landing was easy and normal.

Postflight Analysis

I estimate that I had the jet in sight for five to 10 seconds and that he saw me and pulled up about one to two seconds out. He was in an A-7 traveling at 360 knots, terrain following on a low-level route, and I was coming more or less head-on at about 60 to 65 knots. I, therefore, saw him about 0.7 to 1.3 miles out as he came over the ridge. I probably saw him first because I was headed directly toward the jet when I first saw it and was headed nearly toward it the whole time, presenting a very small visual cross section. If the Navy A-7 pilot hadn't been flying heads-up, I don't think I would be writing this story.

Private aircraft are allowed to fly in military low-level training routes but are discouraged from doing so. The rule is as always, see and avoid. The Navy pilots I spoke to usually fly at either 360 or 450 knots, and the routes are between 200 and 1,500 feet AGL and usually extend two nm on either side of the centerline marked (as little grey lines) on Sectionals. Judging from my experience, if you are lucky and happen to be looking in the right place at the right time, you might see, but you do not have time to avoid. In retrospect, the best thing I could have done when I saw the A-7 would have been to immediately bank away to show him as much wing area as possible, and to hope he saw me in time. (An even better thing would have been to avoid the low-level route.) The difference in maneuverability between an A-7 and an LS-4a is awesome. Turning away would have required relinguishing the illusion of control I had over the situation and would probably have caused me to loose sight of the jet under my belly, which is why I did not.

Aftermath

The aftermath of this incident was in some way more traumatic than the collision itself. (Although I have subsequently taken an occasional extremely fast, hard look at a speck on my canopy.) When I landed, I got a call from a Navy spokesman, who informed me that the jet I had collided with was a single-engine A-7 and that the pilot had landed safely at Miramar. He had had troubles of his own swallowing my tip down his engine (I think it nearly choked on the aileron hinges) and could not come back for a look; he was certain he had killed me. The sheriff and the fire department showed up and wanted reports, and I also got a call from the FAA, who also wanted a report. A TV station from San Diego showed up (also wanting reports), and some friends from Hemet appeared and rescued me and my 14 meter LS-4a. About a meter of wing was gone, and the aileron was gone for another ½ meter and was split at the trailing edge.

The following week I cooperated with four separate investigations by the NTSB, the FAA and both a legal and a safety investigation by the Navy. I also had to explain things to my partner, Stan Foat, and spent a lot of time on the phone trying to find an LS-4 wing.

Alan Bikle rebuilt our wing tip, and we ordered a new aileron from Germany and were flying again in June. We collected some reimbursement (half of what my partner and I asked for) from the Navy, contending that gliders have the right of way even in low-level routes. The Navy people were very straightforward, and I enjoyed dealing with them — I did not encounter the bureaucratic ineptitude that I expected.

I no longer ignore the little grey lines on my Sectionals. ●

Reprinted from Soaring and Motorgliding.

Try to see yourself as others see you — but try not to get angry about it.

Ace L.

Vector to a Bird Strike

By Lt. Joseph M. Vrtis

"HAWKEYE, Prowler 606 mark on top a group four, heading 085 degrees, 15 knots."

"Roger 606, your next target bears 190 degrees, 35 nm."

You guessed it, another exciting SSC mission while deployed on USS *Gray Boat.* We had been photographing ships for about 40 minutes under the control of our E-2. Sure, SSC is simple enough. Just fly your assigned heading until you get your target on radar, swoop down along side it and snap its picture, right? Or is there more to it?

"Hawkeye, Prowler 606 has a radar contact bearing 195 degrees, 15 nm."

"Roger Prowler, that's your target."

With our prey on radar, we pressed into 10 nm attempting to gain visual contact. But for some strange reason, this definitely radar-significant target was nowhere to be seen. The existing weather conditions for that day were beautiful. We had been gaining a visual on all our previous contacts as far as 16 nm and no later than 8 nm. My right-seater commented that this particular contact must be an extremely small fishing boat. Sure, that would explain why we hadn't obtained a visual, but the radar returns we were receiving indicated at least a supertanker-size vessel. We pressed onward.

At 8 nm we started a descent from 3,000 feet to be set up for our picture run. At 5 nm, still descending, we still did not have any visual contact with our radar target.

"Hawkeye, Prowler 606, do you show us on top our contact?"

"That's affirmative Prowler, report a tally."

"Roger Hawkeye, we're still looking."

Wow! We must be blind! If the E-2 and our own radar are painting this target, where the heck is it? At that point we were at 1,000 feet, descending, and just about on top of our radar blip. Our eyeballs were bulging, looking everywhere down at the water wondering how we ever passed our last eye exam. All of a sudden, at 500 feet, I glanced up and caught sight of our elusive target. A 747-size flock of birds was heading perpendicular to our flight path at 800 feet. After taking the appropriate 5 G maneuver, we composed ourselves and reported our findings.

"Hawkeye, Prowler 606, that contact you vectored us to is a large flock of birds heading 270 degrees at 800 feet.

"Roger Prowler, suggest you avoid them."

Great advice from someone who almost vectored us to a bird (flock?) strike in the first place.

Although we didn't receive photo-of-the-day honors for our feathered cloud effort, we did learn some valuable lessons. A routine SSC mission just doesn't exist. Flying in close proximity to the water and other ships is a constantly demanding evolution. Throw in some unforseen factors and the chances for excitement became a reality.

The E-2 is our big brother in the sky. He gives good information based on his system, but let's remember —it's our noses we stick in the direction of his vector. SSC missions demand that we focus our attention towards the water in order to find the ship were being vectored towards; however, let's not tighten those blinders down too hard. Since we share the sky, we have to stay vigilant for our feathered friends. ●

Lt. Vrtis flies EA-6Bs with VAQ 137.

Low-Level Liabilities

By Flt. Lt. S.P. Baker, RAF

I WAS 2nd Officer on the *Norman Lady*, which was then the largest gas tanker in the world. We were en route from Das Island in the Persian Gulf to Chiba in Tokyo Bay. The *Norman Lady* was loaded with liquid natural gas, which was held in five large globular tanks, the tops of which were 100 feet above sea level. The large turbine engines moved the enormous structure through the ocean at about 20 knots, and to achieve this speed, the waste gas from the cargo was burned as fuel. As the ship vibrated, the surface of the liquid gas boiled off: It changed to gas and was fed to the engine, which gave more gas and so on. The ship ran to a very tight schedule. The longer the journey took, the more cargo heated up and was vented, and the less cargo the ship delivered. It was, therefore, desirable to cause maximum boil-off so as to get the best speed. Whatever interest is this to a pilot? You will soon see.

As the gas boiled off, it collected in the top of the large globular tank. When the pressure became too high, the pressure vent in the top of the tank opened and vented tons of highly flammable gas. To prevent this gas from igniting, the high-pressure valve would not release until the pressure was sufficient to carry all the gas clear of the ship's accommodation. In still air this gas vented to considerable heights, and since it vented automatically, you never knew when you were going to be surprised by an almighty ear piercing jet of escaping gas.

On this particular occasion in the Pacific Ocean, we were overtaking a large U.S. Navy fleet, which we did with great British pride and much to the annoyance of the fleet (which we somehow seemed to go through instead of around). It was a clear day and very calm, and two aircraft came across, presumably from the carrier, to have a look at us. From the bridge of the *Norman Lady*, we could actually look down on the jets as they approached from our stern. I stood on the bridge with the seamen frantically waving in a bid to turn the aircraft away. The two aircraft passed low overhead, and one of the pilots gave a friendly wave. Much encouraged by all our waving, he climbed steeply, impressed us with his skill, and returned yet again for another low pass. We were very thankful that none of the tanks decided to vent at that moment, or the story may have ended quite differently.

That all happened a few years ago now, but the number of gas tankers has increased rapidly since those days. The *Norman Lady* and her sister ship, the *Pollinger*, are still in service; and one easily distinguishes them by the large Moss Rossenberg designed spherical tanks, which are painted international orange. As the *Norman Lady* is now under new ownership, I was only able to obtain technical data on the *Pollinger*. The height to the top of the vessel from the waterline is 136 feet and to the top of the gas risers, 117 feet (certainly worth avoiding when low-level over the sea). Before arriving to load, the tanker has to vent gas to cool the tanks. If there is insufficient wind, it is necessary for the vessel to operate stern first while venting to avoid gassing the crew in the aft accommodation. Although the gas disperses quickly on a windy day, large pockets could be in the air in very still conditions. More difficult to avoid are the liquified petroleum gas (LPG) tankers, which have to vent gas more often. These large vessels trade the North Sea regularly en route to the Norwegian oil fields and are not easily distinguished from a conventional tanker. I am sure all those who serve on LPG and LNG (liquified natural gas) tankers would appreciate being given a wide berth by all military aircraft.

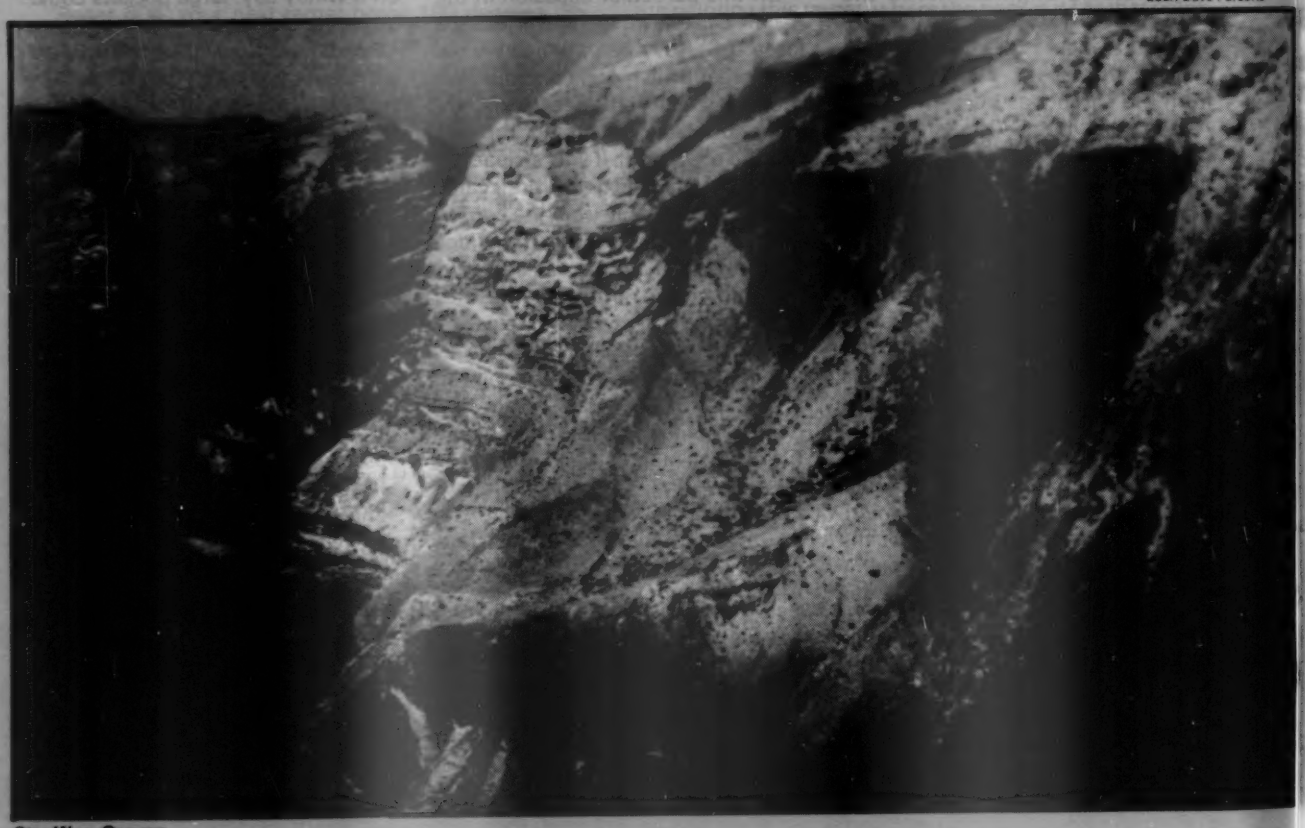
Modern supertankers have heights well in excess of those given in this example; however, there should be no gas hazards from these larger vessels carrying heavy oils. Therefore, all you friendly pilots show some concern for those at sea, not by convivial waves but by giving them a wide berth, especially if it is a tanker or it is painted international orange or moving stern first. ●

Reprinted from Flight Safety Review, A Royal Air Force Safety publication.

A Near-Fatal Flight

By Lt. Mark Fox

LCdr. Dave Parsons



Star Wars Canyon

EVERYONE agrees that we must learn from other's mistakes. Certainly no one could live long enough to make every mistake for himself. This near-mishap could easily have been my last — and worst mistake.

It was a beautiful, clear day off the coast of Oman. As I manned my A-7, I had that "on the step" feeling. Everything was going well; I had a string of eight OKs going on the 'greenie board', and I was especially enjoying the flying we were doing over the beach. We were participating in our third Beacon Flash exercise with the Omani Air Force in as many months. They were a welcome change from the repetitious routine of blue water ops.

Our mission that day was to fly an opposed low-level, use a pop-up attack to deliver practice ordnance, then execute a low-altitude egress to the coast. I was Dash 3 in a flight of three.

In the previous two exercises, we had flown through a rugged canyon with walls rising more than 2,000 feet above the dry winding river bed. Since the river flowed toward the coast-out point nearest the ship, it soon became standard practice to fly through this particular canyon on the way back to the ship. The air wing aviators dubbed the river gorge "Star Wars Canyon." One of the beauties of going feet wet via the canyon was that it offered any desired degree of difficulty in terrain-masking: Flying near the top of the canyon walls presented little challenge and required mild maneuvering, if any, to follow the river's path. On the other hand, if you flew closer to the canyon floor, the walls were narrow and the twists and turns much more pronounced, requiring constant maneuvering. Flying through Star Wars Canyon was fun.

Naturally, every aviator in the air wing took the high-altitude and low-degree-of-difficulty route the first time. As the air wing became more and more familiar with the canyon, we moved our altitudes down to appropriate comfort levels for low altitude flying over land.

Almost every flight over the beach was highlighted by a quick trip through the canyon on the way back to the ship. In fact, so many aircraft were heading through the canyon that we had to establish a one-way traffic rule after some A-7s were underflown by an A-6 going the opposite direction.

There was one S-bend in the river bed that made a right 90 degree turn followed immediately by a left 90 degree turn. The canyon walls were essentially vertical at this S-bend for the lower quarter of the canyon. There was enough room to fly through the S-bend — you just had to do two quick Reno-style pylon turns in rapid succession to negotiate the course. I had studied that particular S-bend several times from above before I ever stuck my nose into it. After a few trips around it, I added it to my aerial repertoire.

We flew the mission as briefed: low-level ingress over the flat desert, dropping our bombs in a well-coordinated pop-up attack, and egressing at low altitude. As we entered the mountainous areas, we dropped out of our tactical triad formation into trail. As Dash 3, I brought up the rear, maneuvering to stay clear of jet wash.

We dipped into Star Wars Canyon and snaked along *beneath* the canyon rim. I was feeling cocky — our low-level had been right on, and my bombs hit the targeted truck convoy exactly where I aimed them. As I approached the S-bend in the canyon, I instinctively descended and unconsciously accelerated. I knew I could whip between those granite walls with ease. I had done it only the day before.

As soon as I committed myself to the lower canyon route, I realized in a split second that no, this wasn't the same as yesterday, "Oh man, I'm going more than 100 knots faster than I was yesterday," I thought. I felt a shot of cold ammonia in my heart. The turn radius at this speed was too great to negotiate the 90 degree turn. I couldn't slow down and there was no way out. My conclusion was that I was going to die.

But my past life didn't flash before my eyes. I was staring at the flight path marker on the gray-brown granite wall ahead of me, pulling with all my might in a knife-edge turn. The airplane shuddered in buffet. My muscles tensed up, waiting for the impact. Then a miracle! The far wall flashed beneath the nose of my airplane. I quickly reversed to negotiate the second turn, then I began a shaky climb to an altitude above the highest obstruction around.

I rejoined the flight after the other two had completed their trip through the canyon. My knees literally shook all the way back to the ship as I pondered how close I had come to killing myself. The only evidence would have been the shattered wreckage of what had once been a perfectly good A-7E, lying in a twisting river gorge in Oman.

Well, among other things, my string of OKs ended that day with a fair 1-wire. Thinking back on this incident, I reevaluated the faulty judgment that nearly cost me my life. I wasn't showing off. There was no one to witness my maneuver. I was merely mindlessly repeating a challenging bit of flying because it was there to be done. What I didn't consider was the consequence of changing one of the variables — airspeed. I have only the A-7's magnificent ability to dissipate energy to thank for my life (and a benevolent God who looks out for fools and naval aviators.)

So the real thrust of this article (other than to warn the fraction of you who may someday fly through Star Wars Canyon around that S-bend) is to induce some introspection on your thought process while flying, regardless of your community. I survived my worst moment in an airplane by the narrowest of margins. I emerged a wiser (but no sadder) aviator. ●

Lt. Fox was flying A-7Es with VA 72 when he had this experience. He then reported to VA 174 for a brief assignment before joining VFA 132 flying the F/A-18. He has recently reported to NMPC as a detailer.

501... You're On Fire

By Lt. Michael D. Bowers

NOW that's a radio transmission I would never care to hear, especially if I was in 501!

The Medium Attack Warfare School training we were going through was intense and rewarding. We were finally unleashed from our normal collateral duties to do what we liked best: fly low and fast through defended airspace and put bombs on a tactical target. On the day of our mishap, our mission was to lead a section of Intruders on a low-level route through Washington's Cascade mountains and simulate the delivery of conventional ordnance on an enemy target complex. The basic mission was easy enough; low-level attack is our bread and butter. What made this particular flight so demanding was the pair of aggressor A-4 Skyhawks simulating MIG-21s waiting for us along the route.

The route to our target took us down a narrow canyon. With both of our Pratt & Whitney J-52s at military, we were flying at 500 knots groundspeed. With our combat checks complete, we entered our delivery maneuver: a 4-G pop-up to a computer release. At the apogee of our pop, we saw the target — a road intersection and bridge in the bottom of the valley. I scanned outside for our aggressors; they knew where the target was and would be looking for us here for sure. With our simulated bombs away, my trusty driver and I concentrated on the business at hand: getting to friendly territory without being tapped by the Skyhawks.

With only miles to go to our designated feet-wet point, two things happened nearly simultaneously. First, we heard our Dash Two call, "Bombs away." Then we spotted our bogies. They had been waiting for us off target and were planning to ruin our day before we entered friendly airspace. With both our sets of eyeballs on the bogies, the pilot rolled our A-6 into a sharp defensive turn. I heard a strange humming develop from somewhere within our aircraft. I listened for a couple of seconds before I piped up, "What's that?"

By the time we broke off our defensive maneuvering, the hum had become a dull roar. We rolled wings level and scanned our engine instruments. The pilot began an easy climb and pulled both throttles to idle. (They had been at military since our ingress to the target). All engine instruments were normal and no annunciator lights were illuminated, but our roar was getting louder and was now accompanied by a slight airframe vibration. We began to discuss the possible cause of the noise and vibration.

We didn't have much time to ponder because we immediately heard the UHF radio transmission I'll never forget: "501 . . . you're on fire!" Then our wingman called, "You have flames coming from your right tailpipe!" I've always wondered how I'd react in extremis situation.

Undeniably, my first actions were defensive. While watching the pilot secure the starboard engine, I tightened my lap belts. I just knew we were going for our land survival trip for real. With the engine properly secured and the aircraft still climbing, we received more bad news. Our wingman, now joined on our starboard side, reported that there were still flames coming from the tailpipe of our right engine. Now, this report may not have excited your average Top Gun crew, but an afterburning Intruder has not been invented.

Grasping the lower handle of my ejection seat with both hands, I told the pilot, "I'm jumping out!" After all, if the flames weren't a positive indication that we were on fire, nothing is. The pilot insisted, "I've got it — give it a second more." Our wingman came up on the UHF again, this time reporting that the flames were gone and that the engine was only trailing a small amount of smoke. We stayed with it, convinced that the fire was out and that our Intruder could still safely aviate.

We immediately declared an emergency with Seattle Center and proceeded to an Air Force base 80 miles to the south we knew to be a suitable divert. Escorted by our trusty wingman, we completed all of the pertinent procedures contained in our NATOPS PCL and prepared for a single-engine approach. My pilot brought our stricken Intruder safely to rest on the long runway of our divert with a flawless approach and landing. Our wingman returned safely to home base. We were escorted by a cavalcade of firefighting trucks to our assigned parking space where we gratefully exited our aircraft.

When they arrived, our squadron maintenance personnel found our starboard engine had seized; it had suffered a catastrophic internal failure. The flames our wingman had seen were caused by hot engine exhaust igniting engine oil, which had spewed from the crippled engine.

Should we have ejected? The engine exhaust fire was there, but there was no fire warning light in the cockpit, no detection of fire outside the casing of the engine itself or within the airframe.

Would we have secured the engine without a wingman? Doubtful. We were unable to determine the nature of the problem from our cockpit. It took a good call from an alert wingman to make us secure the engine. Indications of failure would have occurred eventually, but would it have been in time to save the aircraft?

The pilots and NFOs who fly Navy aircraft are the final QA, the final decision-makers. NATOPS knowledge is essential. The total elapsed time from my hearing a hum to the engine fire being out was no more than 10 seconds. Quick action in a demanding emergency is the answer — there won't be time to read the book when your aircraft is burning. Most importantly, common air sense and situational awareness are two things you can't safely fly without. Remember that when you hear, "You're on fire!" ●

Lt. Bowers is a B/N with VA 95, an A-6E squadron at NAS Whidbey Island, Wash.

"Goggle-Up!"

By Ist Lt. Edward B. Westermann, USAF

THE mission actually started long before the UH-1N was scrambled from its base in the Bahamas. Two hours earlier, a U.S. Customs radar station acquired the slow-moving light aircraft skimming low over the waters of the Atlantic flying an arc that placed it squarely en route for one of the many small landing strips dotting the Bahamas Island group. The lack of a transponder squawk and a filed flight plan, especially for a night flight, resulted in the launching of a specially equipped Customs radar aircraft (Mike 67) that assumed a watchful eye over the unidentified visitor.

As the unidentified aircraft approached the refuge offered by the hundreds of islands, the helicopter crew (Targa 39) scrambled and proceeded south to assume a station-keeping orbit under the direction of Mike 67. With Mike 67's vector to the target and at an altitude of 1,000 feet, the aircraft commander called, "Goggle-up!"

The AN/PVS-5 night vision goggles (NVGs) can be unwieldy, and in the blacked-out confines of the cockpit, it was a full five minutes before the copilot was ready to take the controls. The new AN/AVS-6 Aviator's Night Vision Imaging System (ANVIS) will reduce the goggle-up time to seconds with the specially developed visor mounting that allows the goggles to be flipped up or down. However, procurement and supply was not on the mind of the aircraft commander as he adjusted his own NVGs and resumed control of the aircraft.

The unidentified contact was feinting from one possible landing site to another in the hope of confusing any unknown watchers. Targa 39 slowly descended to 500 feet. The crew consisted of two pilots and two NVG-equipped scanners in the cabin along with a complement of three Bahamian Strike Force Team members. The HAC was flying the helicopter by looking under the cutaway goggles and relying strictly on his instrument flying technique. The goggle focal length was 10 inches to infinity, but flying over water at night without light or land references using the

Operational Characteristics of the AN/PVS-5 and the AN/AVS-6

	AN/PVS-5	AN/AVS-6
Focal Range:	10 inches to infinity	10 inches to infinity
Depth Perception:	Reduced	Reduced
Magnification:	Unity	Unity
Visual Acuity:	20/50	20/40
Field of View:	40 degrees	40 degrees
Weight:	32 ounces	23 ounces approx.

AN/PVS-5

AN/PVS-5

NVGs alone could quickly cause a severe case of vertigo as the horizon and sky merged into one black void.

"Targa 39, proceed one-four-zero. Target appears to be on final for approach," came the crackle of Mike 67's instructions. The HAC had picked up the silhouette of the small island five minutes before and was now racing at 110 knots and 50 feet above the trees as the goggles' phosphor tubes cut through the darkness exposing a uniquely green and almost ghostlike image of the terrain below. With 75 percent moon illumination and a slight overcast, the goggles were working at near-optimum efficiency. There would be no need for the infrared-filter-equipped searchlight used on missions with less than 20 percent illumination.

The makeshift landing field was now in sight: a double row of beer bottles filled with gasoline and stoppered with pieces of cloth lighting the way for the twin Cessna, which was completing its landing roll. The pursuit proceeded exactly according to plan; the helicopter arrived only seconds behind the now idling Cessna. Here is where the NVGs would pay off as the pilot would need to make a near flawless approach into the unfamiliar clearing below. Crew coordination would be at a premium with the scanners helping to clear the aircraft safely down.

The 40-degree field of view provided by the two monocular lenses is often described as trying to look through two separate 6-inch tubes. It requires an almost continuous scanning motion by the pilot. The 32 ounces of goggle weight quickly induce fatigue, a definite planning factor on longer missions.

"Clear down left and right," came the flight engineer's call as the helicopter's skids thudded to the ground. The degraded depth perception of the

goggles, especially for distances under 20 feet, had resulted in more than one "firm" landing. The Bahamian Strike Force Team was out of the helicopter now and racing towards the now-silent aircraft. There was no resistance from the smugglers and no attempt to escape as the Cessna had used nearly all of her fuel to reach the remote landing site. The flight back to the base would be routine and almost relaxing after the adrenaline-pumping rush of the chase.

After clearing the landing area and climbing back to 1,000 feet, the crew had taken off their goggles. Indeed, the goggles would be nearly useless as the helicopter descended for landing with the lights of the city effectively washing out the phosphor picture. The smooth coastdown of the rotors and 300 pounds of confiscated cocaine signaled the close of a successful mission.

This is a fictionalized, yet realistic, mission scenario for the flight crews of the 48th Aerospace Rescue and Recovery Squadron in support of the Vice President's drug interdiction program in the Bahamas (OPBAT).

NVGs give the helicopter pilot or his fixed-wing counterpart a useful and, in the case of helicopter combat rescue, an essential tool for the recovery of downed air crews in a high-

AN/PVS-6 Goggle-up position

AN/PVS-6 Goggle-down position

AN/PVS-6

AN/PVS-6

threat environment. However, the NVGs are not a cure-all, and it is important for the pilot to recognize their limitations. The goggles don't magnify an image; they degrade depth perception below 20 feet and above 500 feet, and you see only shades of green.

In addition to their limitations there are several operational considerations to take into account. Aircraft NVG-compatible lighting should be installed for use with the goggles. The standard red instrument lighting degrades goggle performance and should be replaced with compatible blue or green lighting. Exterior lights should be placed in the dim position and partially taped.

Also, moon illumination greater than 80 percent with no overcast tends to slightly degrade NVG effectiveness. In addition, flight into moonrise or moonset should be avoided as a severe restriction to visibility may result. Extended overwater flights conducted on goggles may result in a false horizon illusion. A radar altimeter is an extremely useful tool during these operations. Due to lack of peripheral clues, extended hovering is difficult, especially over water.

Finally, the goggles will allow the pilot to see through light haze and fog, which, in turn, could lead to entering inadvertent IMC. ◄

1st Lt. Westermann is a UH-1N pilot with the 48th Aerospace Recovery Squadron based at Homestead AFB, Fla.

For more on the hazards of NVG use, see NITE Lab, page 31.

RECENTLY, two CF-18s flying as part of two different ground attack missions were involved in what can only be described as a very Near-Hit!

Two four-plane sections, Alpha and Bravo, were flying ground attack missions against two targets separated by approximately 14 nautical miles. Alpha Section had planned four individual attacks on their target, which was a bridge. Alpha Lead, one of the aircraft involved in the near-miss, crossed the IP and was on the target run when the weather became unsuitable due to haze. The section climbed above the haze layer, which was restricting forward visibility. Attack headings were maintained, and further on, the visibility improved allowing the section to continue their final attack runs. As lead began his turn-in to final attack heading, he saw a flash in his peripheral vision on the right side of the aircraft and felt a rumble. The aircraft did not feel right, and his first thought was that he had struck a bird and had lost an engine. He broke off the attack and initiated a climb and then thought the flash had been a glider or another aircraft. Instinctively, he looked back and saw another CF-18 going westbound, in the opposite direction. Lead warned his section about other aircraft in the vicinity and

How Close is Close?

By Capt. D.A. Granger, Canadian Forces

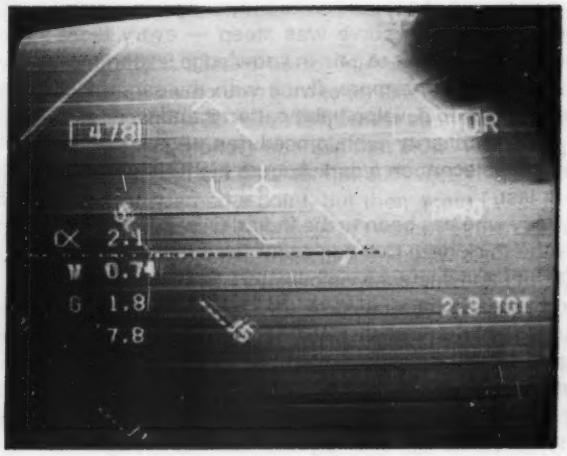
being unsure of how close he had come to the other aircraft, asked his No. 2 to have a look at his aircraft. Alpha Section returned to base, and lead landed off of a straight-in approach after completing a controllability check.

The other formation, Bravo Section, had just completed their target attacks, and it was determined that one of their aircraft was involved. No members of Bravo Section saw the other CF-18 or felt any jetwash.

Using Alpha Lead's HUD video, it was confirmed that Alpha Lead had passed under and very close to another CF-18 travelling in the opposite direction. The six photographs accompanying this article are from Alpha Lead's HUD video and show the other CF-18 appear from behind the HUD velocity vector symbol and proceed up in the field-of-view of the HUD. Both aircraft were approaching each other at a closing speed of 960 knots or approximately 1,600 feet per second. Photo 2 to photo 6 show Alpha Lead beginning his turn-in to his target, not taking avoiding action as it seems to appear. During the whole sequence of photographs, the member of Bravo Section is in level flight. The total time sequence for the six photographs is estimated to be approximately 2.3 seconds. It is estimated that both aircraft passed within 10 feet of each other.

As these photographs so graphically display, the difference between a successful mission and disaster can be as little as inches. ●

Capt. Granger is the editor for *Flight Comment.* He flew CF-104s and CF-5s in the Canadian Air Force.



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The Canadian Armed Forces Flight Safety Magazine.

No One Minding the Store . . .

Again!

By Lt. Bob Russell

FRESH from the A-6 FRS at Whidbey Island, I had a lot to learn about fleet operations. The squadron was in Cubi Point when I arrived, and we left immediately for a three-month deployment to the Indian Ocean. Since I was a nugget, I was crewed with an experienced first-tour pilot who had already completed one Indian Ocean cruise and had 750 hours and 220 traps in the A-6.

The first month at sea was quite a learning experience for me. The learning curve was steep — every flight offered the opportunity to gain in knowledge, experience and air-sense. Furthermore, flying with the same pilot allowed us both to develop habit patterns and work as a crew. This familiarity with procedures allowed us to become complacent on a dark August night that almost was our last.

Anybody who has been to the Indian Ocean in August knows the thick haze that can occur from the surface to 20,000 feet and decrease visibility to 1.5 miles. At night the problem is compounded by the lack of any horizon, and good flying requires a good instrument scan. Such was the weather the evening my pilot and I were assigned to fly missile profiles against a frigate in our battle group.

All safe flights begin with a good brief; this one was off to a bad start because flight profiles and inbound headings were not discussed. Start-up and takeoff were as uneventful as any night cat shot can be. Shortly afterwards we were communicating with the frigate which was located on the carrier's 220 radial at 10 nautical miles. We were directed to make our first run at the frigate perpendicular to the carrier's base recovery course (BRC) of 360 degrees.

Our inbound run began at 30 nm and 5,000 feet, stepping the altitude down to 500 feet at 10 nm. The radar altimeter was steadily lowered to 400 feet where it remained. Passing the frigate we determined that an immediate turn was necessary to avoid the carrier's approach corridor. We began a climbing turn. My attention during the turn was focused on the radar trying to reacquire the ship in order to provide the pilot with system steering information. His attention was outside the cockpit trying to reacquire a visual on the frigate. Visibility was 1.5 nm due to haze. Aircraft attitude and altitude had dropped from both our scans; they were reacquired by the pilot at 1,000 feet with a 1,500 ft/min rate of descent.

My first indication of a problem came when the radar altimeter LAWS tone indicated that we were passing 400 feet. I called "Pull, pull!" but it was unnecessary — the pilot had already initiated a recovery, and the aircraft altitude bottomed out at 150 feet.

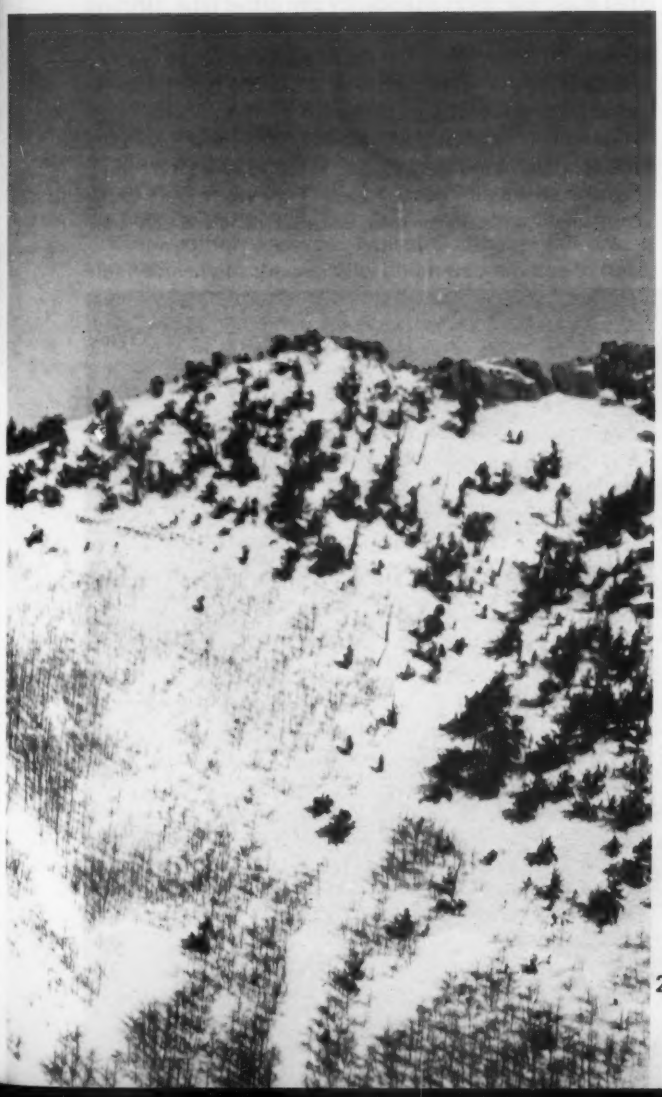
This near catastrophe was one that could have been easily avoided. We should have waited for the recovery to be completed before beginning runs on the frigate. At the very least, we should have been talking to CATCC to avoid any traffic conflicts. As a bombardier/navigator, it is my role, as well as that of the pilot-in-command, to monitor instruments in IFR conditions. And most importantly, a thorough brief discussing all facets of the mission is critical in order to avoid turning the most mundane sortie into your last. ●

Lt. Russell is a B/N with VA 115 who will never be complacent again.

It Doesn't Cry Wolf

A precision approach turns into a low-level flight.

By LCdr. J.A. Rothwell



I HAD been into NAS Desert West more times than I cared to mention and felt that I was certainly as familiar with the field as the next guy. I knew about the field elevation, the crowded skies, the warning areas, and I had more than a healthy respect for the surrounding mountains. Yet, how prepared is "familiar"? Does familiarity, indeed, breed contempt?

It had been a long day, even by logistic support standards, and the crew was tired and anxious to complete the mission. We had left all the delays and weather problems back on the East Coast — we thought — as we prepared for the final approach. We were told to expect a GCA by approach control, and the precision approach was briefed to be backed up with a TACAN. I stressed terrain and minimum safe altitude considerations in the event of a go-around.

Approach passed us to GCA who confirmed "radar contact," giving us a turn to an extended base leg and a descent to 6,000 feet. With power on in the descent due to icing, my copilot remarked that 6,000 feet was quite a bit lower than the TACAN minimum vectoring altitudes at 15 miles. He had a point, but then again I was in radar contact, wasn't I? They couldn't exactly paint me through a mountain, could they? But then again . . .

About that time the ground proximity warning system (GPWS) interrupted our session of 20 questions with a very insistent "terrain, pull up" call. That was enough for me. I executed an immediate full power go-around as I tried to remember to continue breathing. Established in the climb, GCA called for an immediate climb to 7,500 feet. Obviously, I wasn't the only one who had realized that something was very wrong. Fortunately, I came to that conclusion before they did with the help of the little talking box. Subsequent investigation revealed that two aircraft had been passed to GCA, and there was some

confusion as to which one was which. My clearance to 6,000 feet should have been for the other aircraft, and it put my descent path into an area with peak heights of 6,105 and 6,280 feet. The altitude at which my go-around was initiated was approximately 6,300-6,400 feet. We never did break out during the entire evolution; so it wasn't until later, on the deck, that my copilot and I determined just how close we had come to becoming part of a mountain top.

What if we didn't have power on in the descent for anti-ice protection and had to spool the engines up for a go-around? What if we were descending at a normal rate of 1,000-2,000 fpm instead of 400-500 fpm we used because of a little concern with our clearance? But most importantly, what if we had delayed our reaction to the GPWS call-outs?

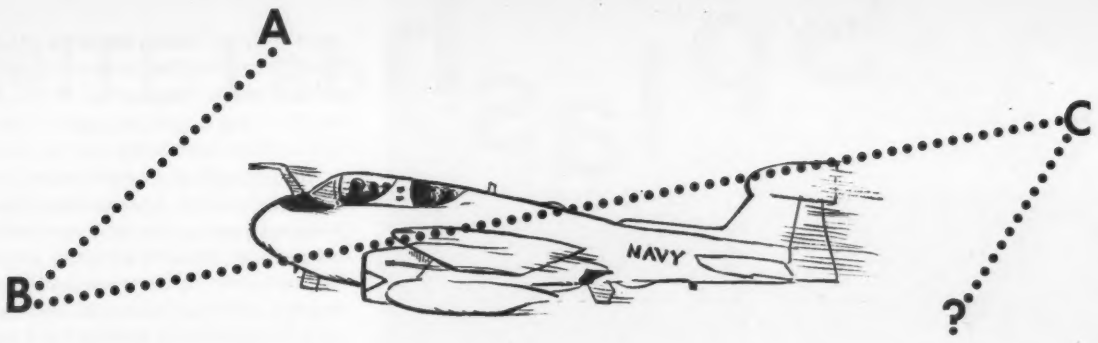
Those first two "what ifs" can be written off to a little Monday morning quarterbacking, but the third merits examination.

The early 1970s were marked with a series of Controlled Flight Into Terrain (CFIT) fatal accidents. As a result of these accidents, a number of important accident prevention developments occurred. One such development was an amendment to Federal Aviation Regulation Part 121 requiring that all large turbine-powered aircraft be equipped with a Ground Proximity Warning System. A 10-year study by NASA into CFIT commercial incidents indicates that for the five-year period preceding the adoption of ground proximity warning systems, there were 17 fatal CFIT accidents yet only two fatal accidents for the five-year period following GPWS introduction. Of these two, one could have been prevented, but the pilots chose to ignore the GPWS call-outs. In November 1979 a DC-10 struck a mountain ridge at Ross Island, Antartica. The accident investigation revealed that although a go-around had been initiated, there was a five- to six-second delay from GPWS warning to pilot reaction. Why the delay? Why do some air crews choose to ignore what a proven safety system is trying to tell them?

Most GPWS activations occur in a controlled visual environment and are only telling pilots what they already know. They're termed "nuisance calls." Most pilots don't feel the need to be reminded that their sink rate is excessive, that they are well off glide slope, or that they have selected less than full landing flaps when they are embarassed enough trying to salvage a rough approach. In these situations they respond, "Disregard," "Pull the circuit breaker," or "Shut that thing up." And then, of course, there's the spurious, out-of-the-blue call-outs when the system malfunctions. In any event, there is a natural tendency to ignore or at least delay any reaction to what the system is telling you. As the CFIT accidents cited illustrate, such a tendency can prove fatal. Ground proximity warning systems are not standard equipment in most fleet aircraft. Yet, with its proven safety record and state-of-the-art technology, it's a safe bet that it will become an integral part of future generation cockpits. Whether you've got it now or get it in the future, take the time to understand the system, listen to what it's telling you, and above all, react. It doesn't cry wolf! ●

LCdr. Rothwell is the aviation safety officer for VR 46 at NAS Atlanta.

R.G. Smith



The Dreaded Flight Violation

By Lt. Lee Hart

THE day started out just like any other. Little did I know that it would end with a close brush with the dreaded "flight violation."

There I was, on the end of the runway with a fairly experienced NFO beside me in my trusty Prowler ready to do battle with any commie radar we could find. First, however, we would have to fly the ever-challenging VR route. Armed with a time-tested chart (which looked as if it had gone through the washer a few times), a stop watch and four sets of eyeballs, we were pretty confident of the successful completion of our mission. With clearance, we leapt into the wild blue.

The weather was your typical Southeast fall day — clear skies with the visibility about five nm due to haze. Approaching Point A, we cancelled with center, dropped down to 500 feet and set our ground speed at 360 knots. We hit Point A, started our clocks and settled into the route. About halfway to Point B, I cross-checked my ADI with the wet compass only to find a 10 degree split. No problem, just synch it up, make a correction and turn on time, which we did. After turning on time at Point B we started the old "do you see anything familiar?" routine. I didn't, but my navigator said he had crossroads ahead on his chart and we were looking pretty good. I should have felt better with his statement, but I didn't. There was this little voice telling me that something wasn't right. The next thing I heard was that we should be at Point C, and that we should turn.

Well, now I was worried. We had turned on time at the last two points. I still didn't see anything familiar, and the little voice was now a shout. The two people in the back seat hadn't said a word since we started, which was highly unusual, and the navigator was sitting there with the chart on his lap nodding his head. Finally, the realization hit me like a sledge hammer: We were lost. However, we weren't lost for long. Just as all of this was coming together, we flew over a popular South Carolina airport almost joining with a 727 in the pattern. Then it was MRT climbing out with our tail between our legs looking for anyone else trying to get in our way. Needless to say, the first thought upon leveling out at 16,000 was "do you think they saw us?" We hadn't heard anything over Guard, so maybe we got away with it. We switched to center and got clearance back to home field feeling like a thief in the night. About 10 minutes later our fantasy was shattered when center came up and told us to switch to the same popular South Carolina airport's approach control; they would like to speak with us. Then came the moment of truth. Before switching, we discussed what excuse we were going to use. INS dump? No, they may know we don't have one. How about we had a major emergency and we were going to land there but saw all the traffic and decided not to. Nah. In the end we decided on the good old nav system failure, vague but believable. So we switched up and in our most apologetic manner, explained the situation. The controller responded, "No problem — have a nice day." Well, I don't mind telling you I could have kissed the guy. After the sighs of relief, we proceeded home to an uneventful landing.

I'm sure there are a lot of people who can't believe we stayed on the deck as long as we did without really knowing where we were. But how many times have you said, "One more minute, we've got to be close"? It's a hard thing to admit you're lost, especially when someone else in the plane says that you aren't. However, once the little voice speaks up the first time and says you may be lost, take notice — you probably are. ●

Lt. Hart flies EA-6Bs with VAQ 134.

If things aren't looking right, you just can't afford not to climb (slow down) and confess, even if it's to yourself. I suspect this situation isn't all that uncommon. Thanks for sharing it. — Ed.

Splash

By Lt. K.C. Hutcheson

THOSE of us in the low-and-fast-over-the-open-water business are faced with an unforgiving enemy. Every year, naval aviators die flying into the water, some, possibly, from poor radar altimeter doctrine or loss of situational awareness. Some just get launched and are never heard from again. There is a certain technique used when a large number of aircraft fly low over the water, but is perhaps not preached quite as dramatically by "survivors" as it should be.

Recently, I found myself in the middle of a flight of eight attack aircraft at 200 feet and 420 KIAS. That in itself is enough to raise a few hairs on the back of my neck, especially with a completely glassy Indian Ocean and no visible horizon due to haze. But even more hair-raising was looking out at my wingman and seeing the top of his airplane! In fact, two of the eight planes in the strike were *stepped down* from the aircraft in front of them. That is certainly not the place to be. Both pilots were nuggets at mid-cruise. *Stepped up* on the aircraft in front is the only place to be in low-altitude formations. Certain death is literally only a moment away, and the habit pattern developed by flying stepped down at low altitude borders on suicidal. It's only a matter of time before you will get scraped off. Flight leaders, don't let your bold new naval aviators learn this one the hard way.

A wingman needs to be looking slightly down on his leader at low altitude. If there is a horizon, it should be above the aircraft in front of you, and you should see water above the lead's aircraft.

Flying formation is a dynamic environment, and you will move up and down to a certain extent. By being stepped up, it is much easier to see downward travel as the horizon above your leader lowers down to his aircraft than it is to perceive the sky between the leader and the horizon (flying stepped down) getting bigger. The amount of sky you see also depends on your lateral distance from the flight lead. *Never* blindly follow your lead. What if he gets busy and picks up a rate of descent? A stepped-down habit pattern will put *you* in Davy Jones' locker first. The idea is for the wingman to notice if the lead is too low. After all, it's much easier to see a shadow and an airplane get closer together than watch a needle move down, especially with hazy horizon and water or with a terrain void of any texture.

When debriefed on this point, the two pilots were slightly embarrassed. "Well, you were up at 250 feet and besides, I had my radar altimeter on. It was no big deal," they said. Developing the habit pattern of flying stepped down at low altitude *is* a big deal! When scans start breaking down and weather gets bad and everything around you is getting confusing, everyone reverts to a habit pattern or trend. Stepped up is for survivors; stepped down is for statistics. By building a bad habit pattern, you are putting yourself in a box when things start getting ugly. ●

Lt. Hutcheson flies A-7Es with VA 27.

NITE Lab

By LCdr. Dave Parsons
Photos by S/Sgt. Mark Walker

THE night vision goggle (NVG) has increased operational flexibility; as the name says, the goggle lets you fly when flight with the unaided eye would be impossible. With increasingly sophisticated threats, the tactical advantage and enhanced survivability of flying low at night have made NVGs an invaluable piece of gear. The tactical helicopter community has fully integrated NVGs into their operational scenarios; fixed-wing communities are soon to follow. To many air crews, NVGs are a "magic" system with which to pierce the darkness. However, the following incidents show that NVGs have some insidious shortcomings. As increased emphasis is placed on night operations, these shortcomings take on an even more ominous cast. In the last four years, there have been eight incidents in which NVGs have been a primary cause factor.

HH-1K Hazard Report Pilot struck unseen barren tree, which broke lower left chin bubble.

CH-53D Class A Mishap Aircraft impacted mountain at night during low overcast conditions; 29 fatalities.

HH-1K Hazard Report Aircraft struck unseen utility power lines.

CH-46E Class B Mishap Aircraft struck trees in confined landing zone.

AH-1T Class A Mishap Aircraft impacted water while orbiting during predawn assault exercise; 1 fatality.

HH-3A Hazard Report Aircraft contacted ground while air crew was attempting to don NVGs in hover.

CH-46E Class A Mishap Aircraft impacted hill en route to NVG training.

CH-46E Class A Mishap Aircraft encountered inadvertent IMC, during turn hit mountain; 4 fatalities.

In 1984, concern over the first of these incidents led to an investigation of these shortcomings and a recommendation that Marine Aviation Weapons and Tactics Squadron One (MAWTS-1) serve as the resident experts on NVGs and develop a solution. MAWTS attacked the NVG problem and not only nailed down the shortcomings, but developed a modular laboratory to deal with them.

Lt. Mike Wilkinson looks on as Maj. Randy Plum sits in CH-46 cockpit coordination module.

In the theater module, an 8-by-10 screen (not shown) allows these aircrewmen to preview actual routes before they are flown. It also allows comparison of the PVS-5 and AVS-6 goggles in the safety of the theater.

The key to success was the pairing of a "user" to a human factors expert. The result was the Night Imaging and Threat Evaluation Lab (NITE Lab) which became operational in January of 1988 and will serve as a prototype for 16 more NITE Labs that are now planned.

The three people who had the greatest role in developing NITE Lab were Lt. Col. Rich Dinkel, ASO for MAWTS-1, Maj. Randy Plum, a CH-46 pilot, and Lt. Mike Wilkinson, a Navy aeromedical safety officer (AMSO) assigned to MAWTS. As their research began moving from the conceptual stage to actual hardware, they were joined by Capt. Rick Schwartz, CWO4 Tim Bahr and CWO4 Dick Wheeler. Their expertise in coming up with off-the-shelf hardware solutions and modifications were instrumental in making NITE Lab operational in record time. Not only did this ingenuity speed the development, but it kept costs at a minimum as well. The saga of finding and procuring the necessary equipment and then putting together a syllabus is another story altogether.

When NITE Lab came on line in January, it had five modular stations for training with NVGs.

Eye lane	for initial familiarization, adjustment
Theatre	for viewing IR imagery on 8x10 screen
Terrain board	for demonstrating varying luminance, weather, shadowing effects
Cockpit room	for demonstrating cockpit interface and laser effects
Optical jamming	demonstrates the effects of lasers, flash, flares and smoke on NVGs

The syllabus designed to go with NITE Lab was introduced with the February 88 WTI class at MAWTS. NITE Lab fills an important role in demonstrating the fine points of NVG usage and revealing the insidious hazards that lay in wait for an unsuspecting air crew. ●

Just

t For a Second

By LCdr. C.L. Boone

IT was one of those hot, dry days in the Indian Ocean, the kind that almost seemed to make time stand still. There was no wind, not even an occasional gentle breeze. Sand and dust from nearby desert locations provided an almost uncanny color distortion to the existing haze layer. Our ship had been at sea for well over 100 days now.

Those so fortunate to have visited this picturesque part of the world during the summer months know all too well the type of day. For one young nugget on his first cruise, this day would soon become anything but "just another day." It would be a time and an experience he would long remember.

The usual ritual preceded the brief — a hot cup of coffee, read over the flight schedule, check the message boards and the mailbox (who gets mail out here anyway?). The usual expletives were expressed about the usual things — wardroom chow, no mail and another hot day on Gonzo station. The brief began predictably with the cheerful weather report: hot and hazy. Today's mission was another SSC (another expletive).

Temperature on the flight deck was the usual 100 degrees plus. During start and taxi, it was evident extra care had to be taken while moving on the flight deck, as the extended at-sea period had worn the nonskid to bare metal in spots. Finally, we spent long minutes sweating profusely. The catapult fired, and we were airborne once again. The long wait on deck in a closed cockpit with 100 degree temperatures had already taken much out of us at this point, especially ECMO One who was already somewhat dehydrated before the brief due to a recent virus.

The first part of the hop went as planned. It should have — we had

done it a thousand times before. Eventually, our fuel state required the usual check-in with marshal, and we proceeded to the old overhead stack for holding. It was becoming late afternoon, and the sun's angle on the haze layer made visibility even more ambiguous. In the marshal stack, the usual thoughts broke through our concentration. How long before we land? Any word on a port call yet?

About that time the unexpected happened. The first group had gone into the break. On the first couple of passes, one of them fouled the deck, and the signal was: max conserve. No one airborne knew exactly what happened (air bosses usually don't share their troubles over the air), and no one knew exactly how long we'd have to hang on the blades. A half hour passed that turned into 45 minutes. About that time advisory calls began to break the silence reporting dwindling fuel states. The response was the best available at the time. "We don't know how long the delay will be. Max conserve..." Before long it became time to visit the tanker.

Enter an unusual situation, requiring undivided concentration and that all important aspect of crew coordination, then couple that with a physically drained crew and you have many of the significant ingredients of a major mishap.

Let us recap the situation at this point. We have a crew on an extended at-sea period, experiencing mild dehydration and lapsing into complacency. A crew that is reacting rather than thinking. Fortunately, one person began to realize what was happening, probably from flight experience.

Our crew had flown together all cruise. The pilot was a senior lieutenant commander with prior time in A-4s. This was ECMO One's first cruise, and there was much to be learned. ECMO Three was a senior lieutenant and mission commander. The pilot climbed to rendezvous with the tanker.

"I'm going to keep us outside the circle a little to give us a better chance of survival in this visibility." Finding the tanker is usually a little tough in the kind of haze that was present, but the KA-6D should have lots of customers today which would make it much easier. Finally, it appeared. Just as we suspected, there was a waiting line.

ECMO One went through the normal pre-tanking checklist and looked left to help the pilot in acquisition. He began to look right but returned his scan to the left when the pilot said, "I've lost them in the sun. Make sure you're keeping a good lookout to the right. Everybody's going to the tanker, and I don't want any surprises." ECMO One again took a glance to the right, and not seeing anything, looked left.

"Are you keeping a good lookout to the right?" asked the pilot. Experience had taught him to be uncomfortable about looking in one direction too long in this kind of situation. ECMO One looked to the right. As he turned his head, out of the haze he could see two smoking objects level with the Prowler at a closure rate that immediately registered as life-threatening. The words rose in his throat and seemed to drag as if he couldn't get them out fast enough.

"Climb! Two A-7s right!" Instinctively the pilot added power and pulled the stick to climb the aircraft out of their flight path. As we watched the two A-7s flash by, we saw no heading change or other evasive action. The two single-seaters had also succumbed to fixation and never saw us. ECMO One realized what could have happened. "The A-7s never saw us!" For the rest of the flight, he would have a problem looking left . . . and no problem scanning right.

How many of you are out there saying, "I've been there" — probably more than most of us realize. A near midair, especially one as close as this one, is a traumatic experience. However, most of us know that if you stay alive long enough in this business of naval aviation, inevitably you'll have a similar experience. Most of us have had several. So what can we do? How can we stay alive?

Lately, a lot of publicity has been given to crew coordination. What is it? How do we use it? Most of us will agree that it should be something carried into the cockpit, and not started in the cockpit. There was a lot of luck involved in the situation described earlier, as well as intuitive insight. Luck, however, can run out, and when it does there had better be some crew coordination to save the day.

Here's my definition of crew coordination: a maximum professional effort by all involved to ensure the safe outcome of any given situation. First of all, by instinct, practice or procedure, it is important just to know what your counterpart is going to do when something happens. This is taken care of largely by briefs and SOPs. It is also important, as in the aforementioned situation, for one individual to almost have a sixth sense for impending danger and start the coordination ball rolling.

Thirdly, and maybe most of all, some thought and practice has to be given to the "what if's," the unexpected abnormal situations — the ones that aren't written in any books. The crew that examines this one closely is probably going to survive any test of crew coordination. Often just the simple knowledge and realization that it can happen to you at any time, no matter how good you may be or think you are, can turn on the red light when you or others are in the danger zone. ●

LCdr. Boone is an ECMO assigned to VAQ 138, based at NAS Whidbey Island, Wash. He is currently deployed to the Mediterranean Sea with CVW 8 embarked in USS *Nimitz* (CVN 68).

It Pays to Fly With the Visor Down

By LCdr. Robert Bason, MSC

ON a low-level navigational flight, an F-4 aircraft was struck on the left quarter windshield by a large bird. The bird entered the forward cockpit, damaged the left side of the ejection seat, tore a hole in the parachute retaining case, and exited through the left side of the front canopy. The pilot felt the bird and pieces of the shattered canopy strike the left side of his helmet, neck and shoulder. Although the pilot's visor was down and not damaged by the flying debris, he was unable to open his left eye and could not see through the visor when he opened his right eye. The velocity of the impact was sufficient to force bird debris behind the visor and into the pilot's eye. Coupled with a blood and debris-splattered visor, the pilot was essentially flying blind.

The pilot immediately initiated a gentle climb to a safe altitude and slowed the aircraft, then raised his bloody visor and cleared away much of the bird debris from his left eye. As his vision began to clear, the pilot assessed the extent of his shoulder injury, cuts on his throat and damage to the aircraft.

The aircraft canopy and cockpit area were damaged. The left quarter panel windscreen and the left half of the front main canopy were destroyed, and 80 percent of the remaining canopy (as well as the forward center windshield) was obscured by blood and debris. Pilot visibility was restricted to only the right quarter panel. Part of the pilot's parachute was flapping in the wind through a hole torn in the retaining case.

The pilot, because of the blow to his neck, was unable to talk and could only faintly hear his RIO due to windblast noise. Intercockpit communication was conducted using the pilot's remaining right mirror. The pilot, having judged that the aircraft was controllable and that he was physically capable of flying the aircraft, elected to recover the aircraft at his home field even though a closer airfield was available. This decision was based on the pilot's familiarity with his home field and the fact that the local area and terrain would provide him with the essential visual cues to effect a safe recovery even with poor external vision. Using visual cues for runway center line in addition to GCA and RIO commentary, the pilot flew a flawless PAR approach to an approach end engagement of the E-28 arresting gear.

The following are the CO's comments about the lessons learned from this mishap.

(1) This pilot retains his sight today because his mask was on and his visor down.

(2) Immediate pilot action was essential. Climb to cope. Reduce airspeed. Assess the situation.

(3) Remain calm. In the aftermath of sudden cockpit damage, the pilot was in severe pain, unable to see or talk, and covered with debris and blood. The RIO also received a shower of debris and blood that covered his visor. While he could see the physical damage to the canopy, he could also see a portion of the pilot's parachute flailing in the wind. Unable to communicate with his pilot and recognizing the force of the impact, the RIO was forced to make immediate life-and-death decisions based solely on his independent assessments of pilot reaction.

Staying ahead of the situation, he was able to recognize pilot judgments and respond as required. ●

Down

I had no option but to eject; so I pulled the seat pan handle, and everything worked as advertised. I felt the rocket fire and myself going out of the craft.

n But Not Out

By Group Capt. W.R. Donaldson
Reprinted from *Flight Safety Insight*

Sqn Ldr. Ross Donaldson (now Group Capt. W.R. Donaldson MBE) of the Royal New Zealand Air Force wrote this after an exchange tour with the U.S. Navy. After completing transition to the A-4 Skyhawk, he reported to VA 45. Shortly after joining VA 45, he had this mishap. About a week after the mishap, while recovering in the hospital, he dictated to tape his very interesting story. In edited form it appears below. Group Capt. Donaldson has added as a postscript his current reflections.

IT was my student pilot's first TA-4 low-level cross country, starting at 1,500 feet. If all went well for the first third, we would let down to 500 feet and then 200 feet. The route was from Jacksonville, Florida, up into Georgia, then west, then south to the Florida panhandle, out over the Western Florida coast, then back to Cecil Field. It was a fine day, no low clouds, just scattered cirrus, visibility 16-17 miles in the smog of Jacksonville but increasing as you got away from it.

The flight did not go very well for the student. During the 500-foot portion of the flight, he wandered about 10 miles off track and found only one checkpoint out of five. After some prodding he acknowledged that he was lost, climbed back to 1,500 feet and found out where we were. We were now late, so we increased our speed to 390 knots. We then descended to 200 feet. I was in the back seat with the seat up for visibility, when all of a sudden everything went black, and I sensed I'd been hit very powerfully by something. My head was pushed back against the headrest, and there was a hell of a rushing of air, a lot of noise, and I was blinded. I yelled, "I have control," not knowing what had happened but thinking that either there had been some sort of explosion in the front seat or the canopy had come off and hit me on the head as it went. It was a moment of terror, the only one that I've ever known: doing almost 400 knots at 200 feet, suddenly blind, and with a lot of noise and rushing air. I tried to talk to the student, pulled back on the control column and closed the throttle. I might also have extended the speed brakes; I don't really recall. It all happened pretty fast. I didn't get an answer from the front seat, so I had to assume the worst and that I did indeed have control of the aircraft. In my mind, I had no option but to eject; so I pulled the seat pan handle, and everything worked as advertised. I felt the rocket fire and myself going out of the aircraft. Things felt fine with no great sensations other than the instability of the seat and feeling the rocket stop. Being fairly close to the ground, I had started to operate the harness release and parachute rip cord in case they didn't do so automatically, but then I felt the parachute open cleanly with no shock. There I was, sitting in my parachute harness at an unknown altitude, not knowing really where I was and still completely blind. I removed my oxygen mask but left my helmet on. I heard an accelerating jet engine noise close at hand (more about that later). I was still making a blind parachute descent. I don't think anything else could be more unnerving.

I released the dinghy from its pack; we were near swamp territory here and I didn't want to drown, having just saved my life with the bang seat. I then thought about breaking my ankle on landing as a friend did recently on a sports parachute jump, so I kept my legs and feet together very tightly and kept saying, "I'm going to hit the ground . . . now." On about the seventh time, I had just started to say it, when I fell flat on my backside. My helmet fell over my eyes, and there I was on my butt, somewhere in northwest Florida.

I just sat there for a while with my chin in my hands, feeling very thankful that everything had worked exactly as expected and thinking about what I would do next. I still couldn't see, which was very annoying. I took off my torso harness after releasing my parachute, took off my G suit and then sat down again. After a few minutes or so, I checked out my face. My face was pretty badly injured and bleeding, so I had to cover it up somehow. The first thing I thought of was the good old air crew sock. So off with boot and sock, a good mop around and then both back on as this might be snake country. At this stage shock must have set in a little, for I was shivering. I gathered my dinghy in (I was still attached to it and my seat pack), sat in it and pulled the covers over to try to get warm. It was about 1630; sunset would be at about 1720. My right eye started working a little; when I looked up it was sort of blue, and it was darker when I looked down. I decided to find my survival radio, so I tied myself to the dinghy and crawled around looking for the radio. I reasoned that it must be

The student said, "My instructor's punched out," and the ATC guy asked, "Are you punching out too?" He replied, "No, I'm staying with the airplane." Next question was, "Where did your instructor's plane crash?" "Well, he hasn't crashed; it's the same aircraft except he's gone and I'm here."

close. The first thing I found was the empty parachute pack, so I threw it away and then found it again. This happened about four times in my circle around the dinghy. I finally found the survival pack, pulled the dinghy to me and got back in. It then took me some time to figure out how to undo the pack. I wasn't all that familiar with it and being blind didn't help. I finally remembered it had a zipper. I found it, and it all unfolded in front of me. I was looking for a bandage for my face. It was bleeding quite profusely, and my flying suit was getting sticky and uncomfortable. Well, I couldn't find the bandages, for everything was packed in a thick polyethylene bag, rolled over several times and then taped up. I was trying to tear the plastic and just couldn't do it, so after all that effort to find the survival pack, I never did get the bandages. I finally undid my flying suit, taking off my jersey and sort of tying it around my left eye. I then found the survival radio and managed to get it unwrapped and going. I finally buttoned myself up in the dinghy and just lay there shivering, waiting for something to happen.

While I was waiting I heard an aircraft at a distance; however, it did not appear to be looking for me, which was disappointing. I also heard guns, dogs barking and shouting. I yelled at the top of my voice, but nobody appeared to hear me. The most annoying thing was that I didn't know what time it was and couldn't judge the passage of time. I tried counting but soon became bored with that and gave it up. I would also fiddle with the survival pack to try and open it but never did manage that. After what seemed a very long time, a light aircraft came right over me. I heard it coming quite a long way off. It's amazing how keen one's hearing becomes when you're sitting in the middle of the bush, not near anything. I could clearly hear trucks and cars on a highway, which was, in fact, about four miles from where I was. The light aircraft flew past me and then back again, so I presumed it was looking for me because it appeared to be circling around the local area. I tried talking to it on 243 megahertz without success, which wasn't surprising; I found out later it wasn't equipped with UHF. After about four circles it went right overhead at what sounded to be a very low altitude. I waved; the engine note changed, and I then knew that someone had seen me.

The aircraft stayed overhead. I soon heard a truck laboring in a low gear as it approached, and then I heard somebody crashing through undergrowth. I yelled at the top of my voice, "Are you looking for me?" and a voice answered "Where are you?" I said, "Well, I don't really know; I can't see, but I'll keep talking until you find me." Within seconds there was a bloke standing beside me, and the sound of those boots crunching through the undergrowth was very welcome indeed. I said, "Who are you — a farmer or a hunter?" and he said, "I'm neither; I'm a state highway trooper. That's our airplane up there. We found you, and we're going to get you out of here and take you to Tallahassee." "Well, that's jolly good, but where am I?" He replied, "Well, you're sitting in a cornfield." It was a field of maize; the corn had been picked leaving the stalks and leaves. They then brought the truck over to me, and I think the ride out across the cornfield was probably the roughest part of the whole journey from there to the hospital. The paddock had been plowed to put the corn in, and we had to cross the mounds. I bounced all around the cab of the pickup truck until we arrived at a hunting lodge. The area was all part of a hunting area, and what I had previously heard was a quail hunt in progress. Once at the lodge, I was transferred to a highway patrol car and raced at what seemed a very high speed to the Tallahassee Hospital. When I arrived I was given the normal hospital arrival treatment and ended up lying in the casualty department.

At this point my student came in to see me, so I think a few lines on his version of the action would now be in order.

He had just regained track and was descending down to low-level, when there was a lound bang and a rushing noise from behind his right ear. He felt me pull back on the control column. He said, "You have control," not really knowing what was going on. So he then asked, "What are you doing?" and waited for a reply. By that stage we were in about 30-40 degree climb. The next thing he knew was the canopy blew, and a loud roar and a flash of flame came from the back. He realized that I had ejected but saw no reason to do so himself. In fact, he thought I'd been inadvertently ejected, as a result of the canopy coming off. He recovered from the nose-high, slow-speed attitude, reapplied power (that was the accelerating engine I heard) and turned back to look for me.

In doing that he got into a spiral dive, nearly hit the trees and feeling rather foolish, pulled up and circled once more but didn't see me. We had covered inadvertent ejection in the flight brief, since about 10 days before, the squadron had experienced such an incident when a student had inadvertently jettisoned the canopy. The student did exactly as he had been briefed; he came up on guard, put out a Mayday and turned his IFF to emergency. He had lost all his electrical instruments including his compass

and attitude indicator. His standby compass, which was attached to the canopy, had been jettisoned with it. In summary, he was poorly placed to get from point A to B. Tallahassee Center answered his Mayday, and he said it was one of the hardest things of his life trying to explain to the guy what had happened. He said, "Well, my instructor's punched out," and the ATC guy asked, "Are you punching out too?" He replied, "No, no, I'm staying with the airplane." Next was, "Where did your instructor's plane crash?" "Well, he hasn't crashed; it's the same aircraft except he's gone and I'm here." Well, after a couple of minutes of question and answer, the guy on the other end got the picture. They took a fix on the location and guided him to Tallahassee Airport. He landed there with a good crowd of fire tenders and ambulances. He pulled up to the ramp and shut the engine down, which stopped very quickly. The engine was very badly FODed with bird because that's what we'd had, a very solid bird strike. He got out of the aircraft, was escorted across to the control tower and was told that a state highway patrol plane was standing by and would he please get in and point out where his instructor had ejected. Fortunately, he had the presence of mind to ring the squadron first. They were pretty inured to this sort of thing because unfortunately, mishaps were not an uncommon feature of squadron life. He then got into the little airplane and toddled off. It was now nearly dusk when they picked up the parachute and dinghy lying in the cornfield and directed the highway patrolmen on the ground to where I was. The rest you know from my side of the story.

From then on I was in the hands of the medics. They did as much as they possibly could and patched me up to the best of their considerable ability.

The mishap investigation determined that we had been hit by a mallard drake, a male duck. It struck the aircraft just on the line where the canopy joins the metal on the right-hand side about abeam of the front pilot's shoulder. It then made its way up the canopy slightly and broke through. At that stage presumably most of its lateral velocity became longitudinal, and the thing moved and hit me on the left side of my face. Another duck went down the engine. As far as any of the U.S. aviation agencies are aware, it was the first occasion when a bird had entered a jet aircraft's canopy from the side. The duck must have been moving at a fair rate of speed to actually get right through the canopy at that particular point.

Looking back on it, if I was faced with the same problem again, of being blinded and not able to talk to anyone or not knowing if there was anyone alive in the front seat, I would do exactly what I did on that occasion. I believe the only thing I omitted to do was to turn on my strobe light — that may have helped the search team if it had been later in the evening. And, come to think of it, I would get to know my survival gear a bit more intimately, especially how to open the container! ●

There are times when you're pressing on, eager to get the job done, when you don't hear the "whispers" loudly enough to make you pause and reconsider what you're doing.

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15 Years On
Some Reflections
on an Incident In One's Life

There was a preface to the story that you just read, and it contains a lesson for all of us.

It was squadron (and Navy attack community) policy that all low-levels be "chased" with the student and the instructor in separate aircraft. It was believed that this increased student confidence and allowed him to get on with the navigation, freed from the presence and distraction of another crew member.

On that Tuesday, my student and I were detailed for a 0700 brief and a 0800 launch in two A-4Cs. One aircraft did not come up on time, so the launch was postponed until 1000. Preflight, start and taxi were normal until we got to the "final checker," the last quality assurance inspection, which was conducted outside the flight line area. A severe hydraulic leak on my aircraft was detected, so we both returned to the ramp and shut down. Maintenance and Ops consulted, and I was assigned a TA-4F as chase replacement, but it wouldn't be available until midday.

At about 1230 we mounted up again, and this time the student's aircraft was unserviceable on start-up — I can't recall the reason, but the Charlie was a recalcitrant aircraft at times. The diagnosis for a replacement was poor, and as the mission IP, I was given the option of flying the low-level dual in a T-bird or cancelling out. My hunger for hours prevailed, and that's how we and a couple of ducks were predestined to meet a few hours later.

On reflection, I suppose someone was trying to tell me that it wasn't a good idea to fly that day, but I wasn't listening to the "whispers." I was determined to fly.

Perhaps there are times when you're pressing on, eager to get the job done, when you don't hear the "whispers" loudly enough to make you pause and reconsider what you're doing. Listen for the "whispers" — it could be your professional conscience calling — or it might be someone else.

Group Capt. Donaldson's tale was reprinted from *Flight Safety Insight*, the Royal New Zealand Air Force's aviation safety journal.

Listen to the "Old Guys"

By Lt. Bob Barkus

YOU'VE been on Gonzo station for two months now. The routine sorties have been boring for at least the last 1½ months. Finally, an exercise is scheduled that promises to provide the exciting flying and useful training that you badly need. The planning and chart-making begins as the anticipation builds for the opportunity to once again get down in the dirt on overland low-levels.

The old guys in the squadron are aware of how easily this good deal exercise could set you up for a really bad day. They ought to be aware — they've been doing this since the days when they were flying "electric" spads off the *Langley*. So the AOM begins: "Now when you guys get out there, take it easy at first. Don't press the deck because . . . and keep the knots down. The desert terrain could be deceiving depending on the sun angle. I remember when . . ." He was lucky. "Keep track of your gas, your fuel flow in the desert may be higher than normal because. . . so watch your fuel ladder. Watch out for birds, especially at . . . and the islands, so stay high in those areas." Everybody is hearing the old guys, but are they listening?

OK, you got a chart and know the route. For fuel purposes you'll stay at 5K for the coast-in and the first 25 minutes, especially since there is nothing interesting on that part of the route anyway. That will give you gas for the last 30 minutes when you'll work it down low, and you'll have enough to be on the ball with 5.0. You've studied the diverts, so if you need to use them you'll be comfortable. The rest of the brief goes in accordance with NATOPS, and you're on your way.

Feet dry now. Not much out here except an occasional camel or pickup truck. Glad you decided to stay high —you're making gas for later. Let's start working it down to get the feel back. There, that's a nice altitude. Now let's put some knots on it; you have plenty of gas. Low and fast, what a rush. You could do this forever. You can't believe they're actually paying you to do this. This sure beats the hell out of SSC. OK, your coming up on the last turn point. Let's make these last few minutes count. On time, pop-up, feet-wet, RTB — that was great. I wish I could do it again.

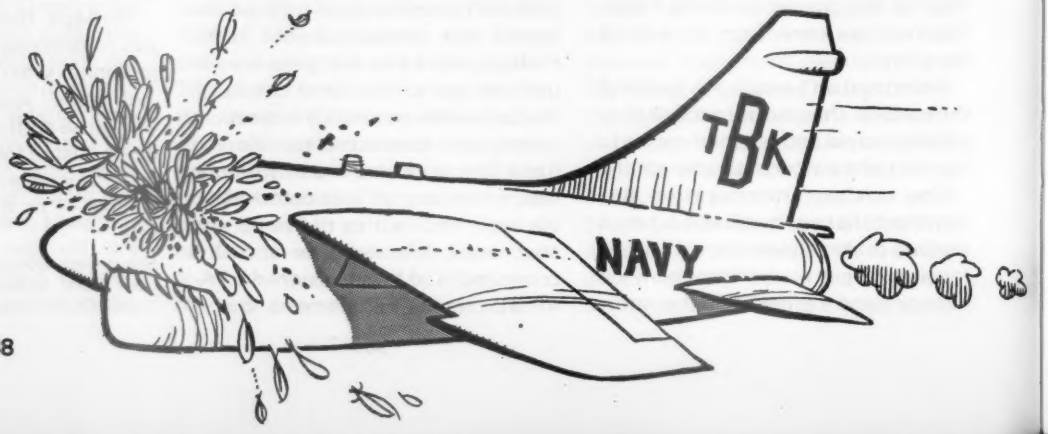
Look at the island. Sure seems desolate. The chart says it has buildings and even an airstrip on it. You wonder how or why anyone would live there. You saved enough gas on the first half of the low-level to have a couple extra grand on the ball; the boat is closer than expected, so time isn't a problem either. You decide to take a closer look. Staying clear of the airstrip, you take it down looking for the buildings and any signs of life. That beach sure looks peaceful, and you think it sure would beat living on the boat. This is a great way to finish up a good hop.

Then, a bird strike! You feel, hear, and could almost smell and taste the sudden violent disruption. But you didn't see it, or at least you didn't see it soon enough, and you knew it was there the whole time. The old guys told you it was there, and it's not even on the chart. Without seeing it you have decided that there is, or rather was, life on that island, and it flies, too.

Pulling back on the stick and jamming the throttles forward, the airplane climbs normally. The engine instruments and flight controls comfortably assure you that luckily you're still flying. You got a break this time. Now it's time for the priorities.

First, aviate. Your natural instincts and reflexes already responded to that one. The airplane is flying and it's controllable.

Next, navigate. Let's see, the boat and the divert are both about the same distance away. The airplane is obviously damaged and will probably need major repairs before it flies again. There is no ground support at the divert, and it would be a major logistics problem to get some there, not to mention the parts that would be



needed. A runway would be nicer than an angle deck at this point, but the plane is flying good, and it makes more sense to go to the boat. Besides, they'll be launching the next event soon, and somebody could come take a look at you. And, of course, there will be a Rep in the tower to offer assistance. With that decision made in less than a minute, you head for the boat. Sweet lock — that priority is taken care of.

Third, communicate. You inform the boat of your problem and request a straight-in. From the first transmission the radio becomes a screaming child in need of constant attention. What a distraction, but luckily you have an NFO to take care of that. Finally, the checklist. The PCL is already open, and the checks and double-checks are performed with the exact thoroughness that had been stressed since your first day of flight school.

During the last five minutes, you realize why you get that paycheck you wondered about on the low-level. This business could be dangerous. No, this business *is* dangerous. You could see pieces of metal and fiberglass flapping around on the left side of the nose. The tanker that has joined on you says the left side of the radome is gone and it looks like your left engine probably sucked up some FOD. You realize that a few more inches and that bird would have been in your lap or probably your face.

One last thing to do, land. Between you, the LSO, your tower Rep and the "Big Guy" on the bridge, you go over all the details. You set it up in the single-engine landing configuration, just in case No. 1 decides to quit on the ball. Like many naval aviators before you, when put into an extreme situation, your training, discipline and professionalism have taken charge.

"607, Prowler Ball, 6.5."

"Roger Ball, Prowler." And it always seems that you get an OK in these situations. Tied down and shut down — it's slider time, and post-mishap flight physical time, and dance on the Skipper's carpet time, and sit on the deck for a week to think about it time. But you're alive, and your landing grades didn't get hurt.

You have all heard this story before in one form or another. I heard the stories before, but did I or do you *listen* to them? This story did, in fact, happen. Although it's a bit dramatized, there was a low-level, an island, a bird strike and a week of sitting on the deck. Not to mention a FOD-damaged engine, a destroyed radome and radar, along with a dead bird that caused a lot of damage but taught a few lessons. There are a few points I'd like to make.

First, listen to the old guys. They know what they're talking about. Sea stories are entertaining, but each one also has a valuable lesson to teach. The thorough training you receive in flight school makes you a qualified aviator. Out in the fleet the old guys can make you an experienced aviator.

Second, when you get the chance to fly good deal low-levels while you're deployed, don't let it turn into a bad day. Spend extra time planning and studying the chart. Take it easy at first. Don't press the deck or sound barrier until you get comfortable. It's a drastic change to the routine you get used to in blue water ops. And by all means, stay away from islands and keep it high for coast-in and coast-out. That's where the birds live, and you can't depend on their look-out doctrine.

Finally, the day will come when your aggressive urges overwhelm your discipline — that is, you do something stupid. If you're lucky and you don't die, you'll have a check in the block for becoming an old guy. Each and every old guy in the fleet has the responsibility of telling his sea stories. Live up to this responsibility — somebody will be listening. ●

Lt. Barkus is assigned to VAQ 130, an EA-6B squadron at NAS Whidbey Island, Wash.

Close Encounters at Low-Level

By Maj. Marvin L. Payne, USAF (Retired)

A 1984 "Broom Hilda" comic strip by Russell Myers showed Hilda and several cohorts flying aboard her broom. Suddenly — dead ahead — there was a mountain over which they had to climb, but the broom was overloaded and underpowered. Going full throttle, and with much shouting and sweating, they just made it over the top when disaster struck. They collided with an overflying airliner and spun from the sky.

It was a very funny strip when I first saw it, but personal experiences have taken the edge off the humor. I had a similar experience in 1980 only it wasn't a mountain I faced but trees; the other ingredient in the episode was an F-4.

Flying a Cessna 188 Ag Truck, I had just started working a field of soybeans with enough insecticide on board to treat 85 acres. The temperature was in the mid-90s, and with a high gross weight, my airplane's performance was definitely marginal. Flying about a foot above the crop, I was intent on maintaining the swath track, watching for obstructions to my next pass and, of course, clearing the tall trees at the end of the spray run. At the last moment, I shut off the spray and started my pull up. Suddenly I heard a horrendous noise coming from behind me, and a second later, traffic flashed directly over my canopy. Shoving the stick forward, I held the laboring Cessna as close to the tree tops as possible and prayed that I wouldn't hit wake turbulence or other traffic. When the nose lowered sufficiently for me to see ahead, I spotted an F-4 (branch of service unknown) just above the trees. I immediately checked for other traffic and picked up a second F-4 about 300 feet to my right. I have no idea if the F-4 pilots ever saw me.

I've had some moments of concern in my flying career, but this incident was absolutely frightening. A difference of one or two seconds could have spelled doom for one or both of us. I circled over my target field for several minutes before regaining sufficient composure and concentration to complete my assignment.

I wish I could say that this incident closed the chapter on near misses for me, but it hasn't. I frequently pull up from a spray run and find myself eyeball to eyeball with a variety of military fighters from all the services. Most of the time, I spot my bogie and take evasive action. On some flights, however, I never see traffic; but farmers watching me work their fields tell me about them later.

To give you some idea of the potential for problems, my area of operations in the northeast counties of North Carolina is representative of many throughout the nation. The area is laced with military training routes (MTR), and within a 20-mile radius of my base of operation, there are currently nine aerial application operators flying at least 12 sprayers. Many fellow Ag pilots tell me of similar experiences in their areas. Why don't we report more of these near misses? Probably for the same reasons that you don't report us, such as: (1) lack of positive identification, (2) too much trouble, (3) both parties are flying legal operations in a VFR "see and avoid" environment. Unfortunately, the resulting lack of statistical data leads to the false conclusion that there isn't much of a problem. Based upon my experience, I believe there is significant potential for problems that could cause the loss of airplanes and fliers if we ignore it.

Although the problem extends to all LBFs (little bitty fellows), let's assess the situation from the Ag operator's position as well as some possible recommendations. There are approximately 7,300 aircraft dedicated to aerial applications in the United States. As sure as the seasons change, these specialized aircraft, flown by hungry pilots coming out of winter financial hibernation, swarm all over rural America. Generating about 2.1-million flying hours

per year, these men and machines serve as partners in agriculture. Their roles include protection of forests and crops from fire, insects and disease as well as application of fertilizer and seed. "Bug bombers" come in a variety of sizes and types.

So what does applying chemicals by airplane have to do with military flight safety? Plenty. You and I share the same airspace. We both have a necessity to operate in the low-level environment. Both Ag pilots and military aviators must recognize that other legitimate and essential air activities are taking place in the same airspace.

What are the answers to this problem? Here are just a few suggestions on how we can operate in the airspace more safely together:

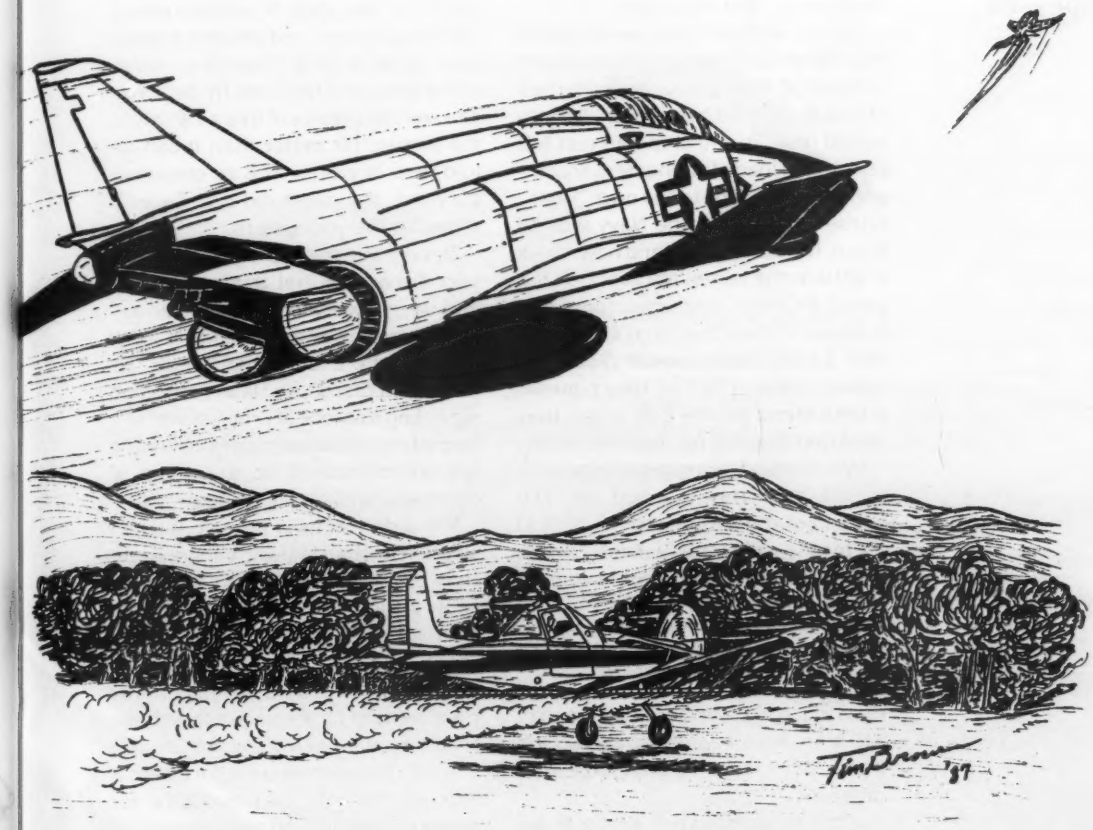
1) During the planting and growing seasons, stay well above the trees in agricultural areas. Ag pilots usually stay below 250 feet AGL while working a field. Therefore, bumping your en route altitude up above that will add some measure of safety without significantly degrading your low level navigation training.

2) Be especially observant during the application season in your area. Expect an Ag airplane to pop up from behind a tree line.

3) Be aware of potential spots in your local flying area where crops are being grown and where Ag pilots are most likely to be encountered. A little "heads up" on where you might find us can add that little extra edge to your visual lookout.

4) Lastly, be informed. Military flying safety officers from area bases have made safety presentations to the North Carolina Aerial Application Association every year since I became a member. Why not reciprocate and invite a member of the aerial applicators association in your state to speak at your flight safety meetings?

Let's work together to prevent close encounters of any kind from occurring. Fly safe and have a good season.



From the best to the worst, there is always a question of professionalism, but more importantly . . .

What Are You Doing About It?

By LCdr. Robert Miller, Maj. Tim Hill, USMC, and Lt. Scott Campbell

Too many low-level mishaps show that (and near mishaps) air crews are doing things on impulse. Careful reading of this article and others in this issue will reveal this ingredient as well as a departure from the briefed mission. If you don't think that will get you in trouble, read carefully — Ed.

SOMETIMES our "best pilots" do the craziest things! One saying at the Safety Center goes something like this: "You read about the worst pilots in the FNAEBs (Field Naval Aviator's Evaluation Board) and the best pilots in the MIRs (Mishap Investigation Reports)." The following tale lends credence to that statement.

Two of our best pilots were tasked to conduct deck handling tests aboard a frigate off NAF East Coast with their brand new H-60 helicopter. As fate would have it, the ship had just left port with a load of youngsters accompanying their dads to sea on a "Tiger" cruise to see what the Navy was all about. Naturally, the brand new, sleek H-60 was the center attraction as the proud air crew conducted tours and boasted of their machine's capabilities. Later, many would recall the crew's comments that they planned a little show for the kids when they departed the ship for their trip home.

When the handling tests were completed, the crew manned up. The captain of the ship asked the pilot to fly by the ship after takeoff so the crew and their guests could see the helo in flight.

The pilot replied "Roger, we've got a little show planned." He returned to the aircraft and briefed the crewman that they'd take off, fly ahead of the ship, reverse course and do the fly by. What followed was somewhat different.

After a normal start and a hover check over the deck, the air crew checked "Clear aft" and commenced a vertical climb with aft drift to 100 feet, quickly followed by a forward, descending transition to pass level with the bridge off the port beam. The aircraft slowly climbed to between 500 and 1,000 feet about a mile ahead of the ship. It commenced a 180-degree turn and entered a steep dive broadcasting "Standby, we're coming around for a low fly-by." You can see the results of this air show in the picture far better than it can be told here in words. The air crewman survived; the pilots did not. Quite a show for the youngsters.

During the mishap investigation it was discovered that this same crew had been observed flying similar air-show-type maneuvers about a week earlier, were told to "knock it off" by the pilot in charge, and later counseled regarding this lack of professionalism. Regretfully, these warning signals were not communicated up the chain of command until it was too late.

We didn't write a new chapter in aviation mishap history with this one. How often do we read of our "best" pilots violating rules of aerodynamics and NATOPS? How many of our "best" pilots are prone to excursions into the realm of poor judgment? How many of us are aware that these things are happening and are tolerant of those aviators who demonstrate a lack of maturity and a desire for personal gratification at any expense?

Think back and you'll realize that it happens far too often. In fact, it happens all the time. The important question is, *"What are you doing about it?"*

Are you one of the "best"? If so, mishap history is telling you that your chance of becoming a statistic is high because of your poor judgment or your disregard for regulations. Are you satisfied with those odds, or will this mishap help to generate a little self-reflection and attitude adjustment? It's your choice.

Those of you who are "fleet average" are the backbone of our safety record because of your consistency, maturity and professionalism. *You* are the best pilots. You have flown countless mishap-free hours and have a lot of experience to offer for the improvement of Naval Aviation. So, COMMUNICATE! That means generate discussions on flying smart. Relate to those aviators with less experience or maturity those close calls, those counselling sessions — given and received — and those times when the rules worked as advertised. Something other than luck is responsible for you being alive today. COMMUNICATE! Your maturity and experience are valuable assets that may help to keep a friend alive. What are *you* doing about it? ●

LCdr. Miller, Maj. Hill and Lt. Campbell are all fleet-experienced helicopter pilots assigned to the Air Operations Division of the Naval Safety Center. Respectively, they flew H-3s, H-53s and H-2s in the fleet.

It's Safe — It's VFR

Anonymous

AS I drove to work that morning, the typical NAS Southwest weather had returned: a crystal clear, sunny day compared to an unusual two weeks of low ceilings, rain with clouds solid to tops of 15,000 to 18,000 feet. I hadn't flown in that kind of weather since the training command back in Texas five years ago. Shooting actual approaches down to minimums was great training for the FRPs (fleet replacement pilots), but I was ready to return to the normal operations of bustering out to the warning area for a couple of hours and back to the break for touch-and-go landings. Besides, it's always safer to fly in VFR conditions. Right?

The brief went smoothly, and all items were covered adequately. We read the aircraft discrepancy book and walked early since it was a cold start.

After takeoff we checked into the warning area and went right into our high-altitude work. First, we flew a full stall series with good recovery techniques. Next, we executed several overhead acrobatics as confidence maneuvers. Again, we were right on the numbers all the way through. We decided to shut down No. 2 engine for simulated low oil pressure. All memory items were executed flawlessly. "I can see the mountains from here, I remarked. "What visibility. OK, let's clean up the aircraft and start No. 2."

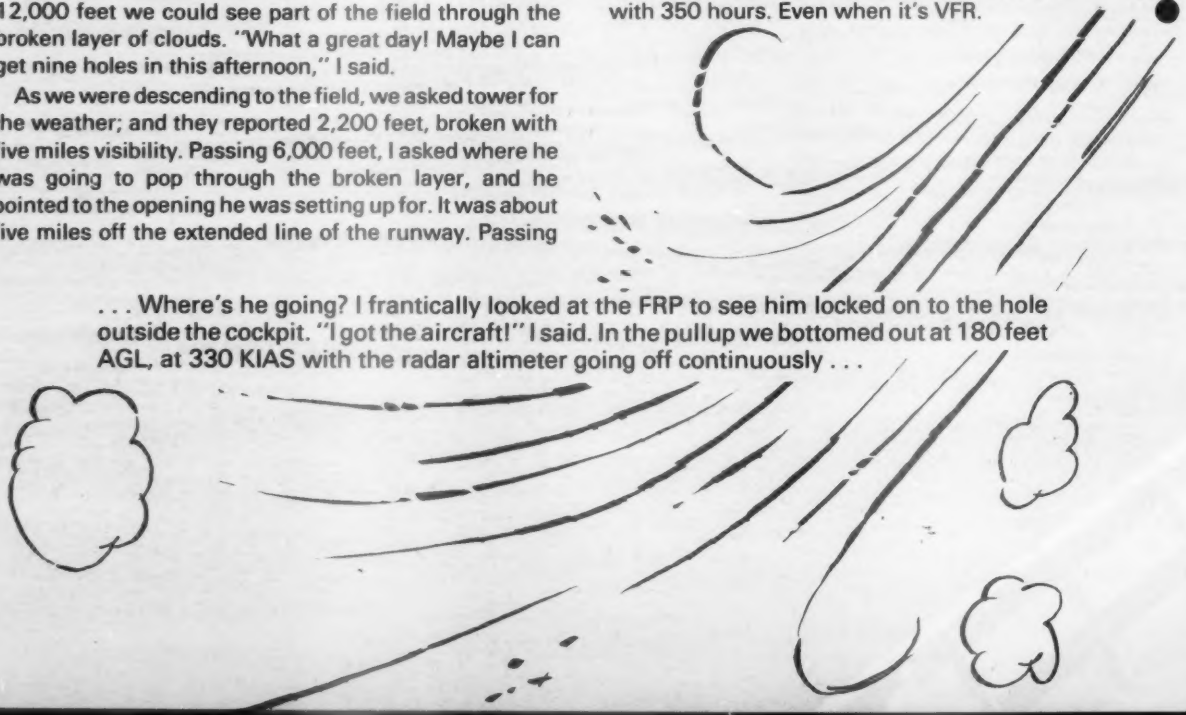
After we got both engines on line, I told the FRP to take me to the outlining field for some touch-and-gos. At 12,000 feet we could see part of the field through the broken layer of clouds. "What a great day! Maybe I can get nine holes in this afternoon," I said.

As we were descending to the field, we asked tower for the weather; and they reported 2,200 feet, broken with five miles visibility. Passing 6,000 feet, I asked where he was going to pop through the broken layer, and he pointed to the opening he was setting up for. It was about five miles off the extended line of the runway. Passing 4,000 feet, I reached down to pull my checklist for the various types of landings out of my nav bag. "Where is it? Ah, there it is. Let's see, six full flaps, one single engine, one single engine wave-off, one no flap . . . is that 1,200 feet on the altimeter? It sure is — 900 feet, 800 feet, 700 feet! Where's he going?" I frantically looked at the FRP to see him locked on to the hole outside the cockpit. "I got the aircraft!" I said. In the pullup we bottomed out at 180 feet AGL, at 330 KIAS with the radar altimeter going off continuously. I immediately pulled to a 30 degree nose-up climb back through the clouds, now realizing it was ground fog rather than clouds.

It's safe to say that it was the closest I've come to being on next week's Weekly Summary of Aircraft Mishaps. As we returned to homeplate, I was more upset with myself than the FRP. One year as a flight instructor, 2,100 hours, 1,800 hours in type, two cruises with work-ups and I almost became a statistic on a VFR day due to a lack of attention.

I had been disregarding the descent to break altitude in order to read my syllabus guide. The FRP disregarded cross-checking his altimeter at 3,500 feet to remain VFR through the cloud opening. Little did we know we were attempting to descend through a typical 400-foot ground cloud layer.

His intentions were to descend through the "forecasted 2,200-foot layer" and come back inside the cockpit to level off at the 1,700-foot initial altitude for the break — a fatal error in judgment. Meanwhile I was worrying about the different types of landings instead of the descent. Needless to say, it was a very sobering experience to realize that you have to earn your wings every day you go airborne. Many a good aviator is not with us today because he forgot the basic minute-to-live rule. One basic rule I'll never forget is that you can bend an aircraft as an instructor with 2,000 hours as easily as a nugget with 350 hours. Even when it's VFR. ●



. . . Where's he going? I frantically looked at the FRP to see him locked on to the hole outside the cockpit. "I got the aircraft!" I said. In the pullup we bottomed out at 180 feet AGL, at 330 KIAS with the radar altimeter going off continuously . . .

The Freebie

By Lt. Patrick K. Thurman

THE deployment was nearly over. It had been exceptionally safe and rewarding, and I was looking forward to some more "sub busting" before going home. The operational missions had been plentiful and the training schedule very busy. I was quickly approaching my NATOPS check ride, having just completed the 2P-fly-5 pilot trainer. This flight consisted primarily of practicing copilot duties and was generally considered (off the record, of course) a freebie. My second-tour instructor pilot must not have heard that, however, and proceeded to grill me on copilot duties and responsibilities. He especially emphasized that the copilot was the main safety observer and was tasked with backing the pilot up on all instrument evolutions. Of course, I had heard it all before (after all, I was **almost** a 2P), but I complied and worked at establishing a vigorous and aggressive back-up instrument scan. After the flight was completed, I was happy to be only two flights away from 2P. Little did I know that an aggressive instrument scan was going to save my skin.

A few days later, our crew prepared to launch on a night operational hop. The weather was 300 overcast with visibility at two miles in light rain. The PPC was to make the takeoff, and I was on the radios in the right seat. After copying our clearance, I listened to the PPC's takeoff brief. Upon receiving our takeoff clearance, the PPC called for max power and concentrated on keeping on centerline on the slippery runway. It seemed that we were in the clouds the second the nosewheel left the deck.

The PPC called for the gear up and, after I acknowledged gear up, called for the flaps. After selecting flaps up and acknowledging flaps coming up, I observed that we were passing through 400 feet with a positive rate-of-climb. I notified the PPC that I was switching to departure frequency. After dialing in the frequency, I noticed the flaps had transited up; I told the PPC.

As I keyed the mike to give our off report, I once again scanned the instruments. What I saw seemed unbelievable — we were *descending* through 300 feet at 1,500 fpm! As I grabbed for the yoke, I called "Descending!" to the PPC. We leveled out at 200 feet and then finally started to climb. Upon establishing a good rate of climb and breaking into VMC at 1,200 feet (and after getting my heart started again), I asked the PPC what happened. He explained that his scan had broken down and he had lost the bubble! My *PPC*! The guy in charge of the entire aircraft had actually succumbed to vertigo. I thought that vertigo only happened to SNAs and jet jocks.

After completing our mission, we discussed the factors that led to the near catastrophe. It had been difficult to transition from outside night VFR scan to inside IFR immediately following takeoff. A second factor was the change of angle of attack and trim requirements due to gear and flap retraction immediately following takeoff.

Other problems included flashing strobes in IMC conditions, the copilot's preoccupation with calling departure too soon after takeoff, and the pilot's failure to notice his predicament.

This sobering experience produced some valuable lessons learned. The copilot's job as safety observer is *paramount* to the mission's integrity. This must be reinforced with a *vigorous* instrument scan. Vertigo is like a cold: *Anyone* can get it! Experience, however, can help to combat its effects. Strobes are no help in IMC. Turn them off when practicable. Have the flight engineer include altimeter or VSI in his scan. The more eyes, the better it flys!

That seemingly insignificant 2P-fly-5, which I had deemed a freebie, actually helped my takeoff scan and contributed to my safety awareness. I will never again underestimate the importance of any training flight. I also learned, even though one might be "only a 3P," when you're in the seat, you *are* the pilot or copilot. Take your job and responsibility seriously. Whether in a multipiloted or single-piloted aircraft, each pilot's responsibility remains the same — *aviate first*! ●

Lt. Thurman is the ground safety officer for VP 10.

Corsair Relight

By Peter Mersky

THE weather was good as the strike formation of six A-7E Corsairs commenced the low-level portion of the mission. About two minutes into the low-level, one of the Corsair pilots noticed he was falling behind the lead. At 200 feet AGL and 490 knots groundspeed, he applied military power with no response.

The pilot checked his engine instruments and saw his fuel flow reading 4,000 pounds per hour, rpm at 80 percent and TOT 550-560 degrees C.; all the readings were decreasing. He radioed that he had major engine problems and began climbing to clear a ridge while reducing the throttle to idle. He experienced a short series of compressor stalls, followed almost immediately by loss of the main generator. He extended the emergency power package (EPP), selected manual fuel and tried an abbreviated airstart as the engine rpm continued to decay.

While he was reacting to his problems, his leader flew over him in an effort to rendezvous and provide assistance. The leader reported a 25-foot long flame coming from his wingman's tail. The hapless pilot soon called that he might have to eject but then obtained a good relight at 260 KIAS and 7,000 feet MSL (1,000 feet AGL).

The flames began to dissipate, then disappeared altogether. The A-7 began climbing at MRT. The leader joined up on the right side, noticing a major fuel leak. The pilot reported he had 5,000 pounds remaining and continued climbing to 16,000 feet MSL, where he reduced power to 91 percent to remain within TOT limits.

Twenty nm from home plate, the wingman reduced airspeed through judicious use of the throttle and speedbrake and descended to 3,000 feet AGL. At three nm, he dirtied up and executed a modified straight-in precautionary approach to a short field arrestment. Engaging the gear, the pilot secured the engine and exited the aircraft. The crash crew found 10-15 gallons of fuel under the A-7 and applied foam to prevent a fire.

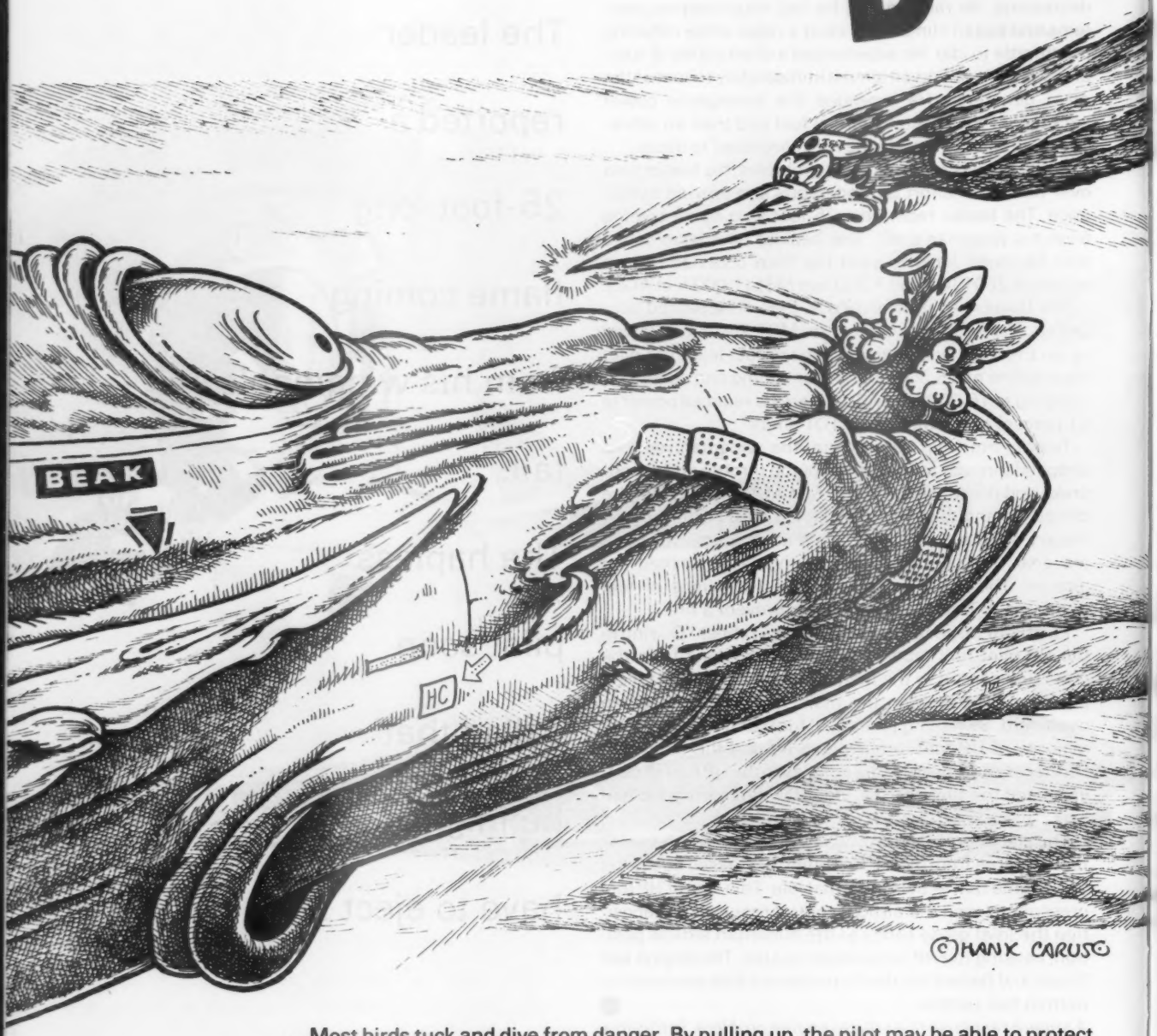
Postflight inspection revealed that a rubber "O" ring in the HP pilot fuel tube assembly (which runs from the main fuel control to the manual fuel control) had failed, allowing HP fuel from the main fuel control to dump overboard. Switching to manual fuel control allowed the majority of HP fuel to be routed around the main fuel control and LP governor assemblies to the HP fuel shutoff valve and the fuel nozzles, virtually eliminating the fuel leak.

The compressor stalls probably occurred when the HP fuel pressure from the HP fuel pump decreased due to the low engine rpm — below normal idle. This loss of HP fuel pressure caused the airflow control regulator to reposition the inlet guide vanes to the minimum airflow position, causing the HP compressor to stall. The engine lost thrust and flamed out due to temporary fuel starvation in normal fuel control. ●

A superb response to a critical engine problem. In this low altitude regime, only timely execution of immediate action abbreviated airstart procedures saved this aircraft. Hats off to Lt. Charles F. Askey of VA 81. — Cdr. G.P. Mulvany, former A-7 Analyst, Naval Safety Center.

The leader reported a 25-foot long flame coming from his wingman's tail. The hapless pilot soon called that he might have to eject . . .

DOD



. . . Most birds tuck and dive from danger. By pulling up, the pilot may be able to protect the canopy or engines by taking a strike on the hard undersurface of the aircraft. . .

GING . . .

Feathered Bullets

By Capt. Russell P. DeFusco, USAF
and
Capt. Russell A. Turner, USAF (MC, FS)

Adapted from *Flying Safety*

During the last two years, the Air Force lost two F-4s, one F-16 and a B-1 due to bird strikes; six of the crewmen lost their lives. The Marine Corps has lost an AV-8B (see Approach August '87 for the pilot's story).

In 1986, the Navy and Marine Corps documented over 900 bird strikes.

A RECENT mishap investigation board determined that the loss of an A-10 was partly due to the pilot's improper response in trying to avoid hitting a flock of birds. The pilot pushed his aircraft down and away from the birds, striking high tension lines. The pilot later lost control of the aircraft during recovery for landing. Fortunately, he escaped without injury.

The question many of you have is "What is a proper pilot response for avoiding birds?" The question is more complicated than it may appear on the surface, and specific guidance has not been available.

The bird-strike problem costing the Air Force approximately $240 million in 1987 (comparable annual cost to the Navy is about $4.5 million). Each year, 2,700 bird strikes are reported to the Bird-Aircraft Strike Hazard (BASH) Team. While many of these strikes are unavoidable, a reduction in the hazard is possible by a variety of means, not the least of which is pilot response to an imminent strike. The effectiveness of a maneuver to avoid birds depends on a number of factors including human physiology, the decision process and aircraft response to pilot inputs.

Studies conducted on pilots indicate the amount of time required to maneuver to avoid colliding with birds. The average pilot tested required 0.10 seconds for sensation of an image to travel from the eye to the brain. Focusing on the sensed object required an additional 0.29 seconds. Perception, or recognition of the object, took another 0.65 seconds.

Each of the above factors will vary between individuals and in differing situations. Object size, relative motion, object color, background color and composition, contrast, and light intensity level, among other factors, greatly influence the amount of time required to perceive an object to be avoided.

The problem doesn't end there. The average pilot required 2.0 seconds to decide to act on the perceived situation. Decision time varies with experience, level of concentration and situation awareness, and is significant in all cases. Once the decision to react is made, 0.4 seconds are required to operate the flight controls (i.e., pull back on the stick).

The response of the aircraft to control inputs varies greatly among aircraft. Larger aircraft generally require significantly more time to react to control inputs than smaller aircraft. For example, we'll use the F-15. This aircraft is capable of an instantaneous pitch rate of 22 degrees per second with maximum control deflection. Assuming a 0.5 second aircraft response to control inputs and a 5,000-foot turning radius at 450 knots, 0.52 seconds are required to move the aircraft 20 feet to avoid a bird strike. At 300 knots, 0.53 seconds are required for the same 20-foot movement.

Totaling all this up, we see it requires approximately four seconds from the time of initial object sensation until the aircraft has moved sufficiently to avoid a bird strike. In other words, at 500 knots, a bird must be sensed from a distance of at least 3,342 feet (0.63 miles) to avoid colliding with it.

It is often not possible to maneuver to avoid birds, and the strike is inevitable due to the birds' proximity. A mishap board investigating a recent F-111 Class B mishap found that, "When one considers mental reaction time and the time that it takes for a control stick input to actually move

the aircraft, it is unreasonable to assume that the pilot could have avoided hitting the bird." In situations like this (when the bird is within the grey region of the figure), it is best to remain level, possibly duck your head, and take the strike. Maneuvering within this region may only create additional problems such as pilot disorientation, unusual aircraft attitude or increased damages following the bird strike.

When birds are perceived outside the grey area of the figure, maneuvering to avoid the birds may prevent a strike. In most cases, birds will tuck their wings and dive if they view the oncoming aircraft as a threat. There are exceptions, however. Gulls, for instance, often turn and attempt to outrun the oncoming threat and are often struck from the rear as a result. Some birds maneuver laterally to avoid danger, but it is the very rare bird that climbs to avoid danger. From this, we can conclude that in the vast majority of cases, you should climb to avoid bird strikes.

Most pilots have an intuitive feeling that a climb is best to avoid birds, but written guidance has not been available. The BASH Team recommends this maneuver for a number of reasons. Most birds tuck and dive from danger. By pulling up, the pilot may be able to protect the canopy or engines by taking a strike on the hard undersurface of the aircraft. Lastly, the possibility of collision with the ground or other structures is greatly reduced.

Since bird avoidance is not a practiced maneuver, you should have an idea of what to do before you encounter a "feathered bullet". Ideally, this avoidance maneuver should be practiced in the simulator so that it becomes an automatic response.

For more information on the bird-aircraft strike hazard problem, contact the BASH Team at Autovon 297-9266/7. Personal experiences or comments will be appreciated. ●

Capt. DeFusco is chief of the Bird-Aircraft Strike Hazard Team at HQ, USAF, Bolling AFB, Washington, D.C. Capt. Turner, a flight surgeon, is chief of flight medicine, USAF Hospital, Tyndall AFB.

Low-Level Relight

By Capt. Jim Kreitzburg, USMC

IT was April 1st and I was scheduled for an AV-8B low-level navigation flight. My wingman and I briefed the flight with special attention to low-altitude safety considerations, especially bird strikes, due to the current migratory season.

The weather was perfect with clear skies and unlimited visibility. The low-level proceeded as expected until we hit the last point. While glancing at my wingman, I saw a flash go by my port side. I heard a loud bang and felt the aircraft rapidly decelerating. Realizing I had a flameout, I switched to manual fuel and attempted to inform my wingman. My call to my wingman never got out as the main generator fell off the line. When the bird hit, I was at 1,000 feet and 400 knots. I immediately began a zoom climb that apexed at 1,700 feet. I then gently nosed it over to maintain 300 knots. My emergency procedure training was paying off as I realized I had automatically turned on the APU and pulled the throttle off. After a short pause I moved the throttle to idle and waited the longest few seconds of my life hoping for the engine to come back to life. I was over water and was not happy about the prospect of going for a swim. I contemplated turning toward land, but realized I would be wasting valuable altitude and energy by turning. I continued straight ahead at 300 knots, waiting for a relight. The next few seconds seemed like minutes.

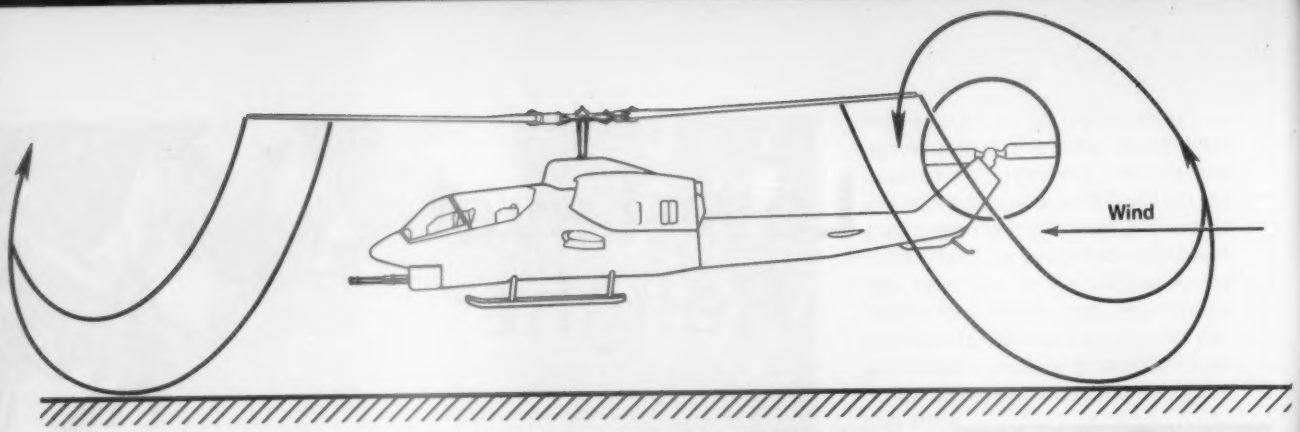
I quickly decided that if the engine did not relight by 200 feet, I would use my remaining airspeed to slow my rate of descent and eject. As I reached 200 feet, I used my right hand to ease back on the stick and my left was ready to pull the lower ejection handle, if necessary.

At that moment, I saw a rise in the JPT and rpm. I eased the throttle forward and began a gentle climb. The aircraft was vibrating heavily. Knowing I still was 35 miles from Home Plate, I wasn't sure I was going to make it. I had my wingman inspect my aircraft for structural damage. No visible damage could be seen.

Anticipating another possible flameout, I set the power at 77 percent and made a fixed throttle, variable nozzle approach. After a relatively uneventful landing, postflight inspection revealed a FODed engine and a hole in the port intake. ●

Capt. Kreitzburg was recommended for the Air Medal. — Ed.

Capt. Kreitzburg flies the AV-8B with VMAT 203, and is the Aviation Maintenance officer for the squadron.



Helicopter-Aero V

oVortex Ring State

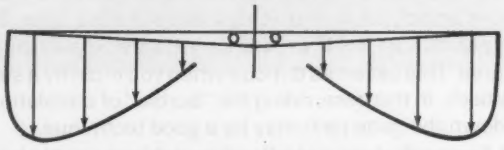
. . . can ruin your whole day.

By Capt. Michael J. Iltis, USAF

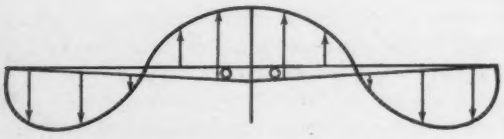
Graphics by Frank L. Smith

HELICOPTERS are particularly complicated aircraft. To the untrained eye, these heavier-than-air hovercraft might appear to have all the aerodynamic characteristics of a brick. Those of us who have flown these machines know better. Yet, even the most seasoned helicopter veteran should pause every now and then to examine the aerodynamic forces at work, particularly when the mission requires operations into unprepared takeoff and landing areas.

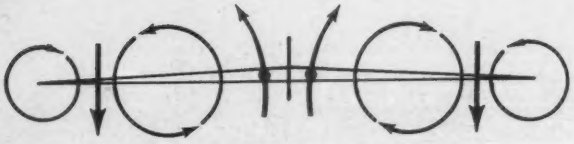
One aerodynamic characteristic stands out as particularly confusing and potentially deadly: vortex ring state (more commonly known as settling with power). A thorough understanding of this phenomenon will help you avoid its possible disastrous results.



Variation of induced velocity along the blade span during hovering flight.
Figure 1



Variation of induced velocity along the blade span during vortex ring state.
Figure 2



Vortex ring state.
Figure 3

Settling with power. Before we discuss the causes and solutions of this problem, we must first establish proper terminology for the subject. Many publications use the phrases "settling with power" and "power settling" interchangeably. Though both conditions may have the same result — broken bodies and bent sheet metal — the causes are significantly different. So to avoid further confusion, we'll refer to "settling with power" by its more correct, technical term, "vortex ring state."

What is Vortex Ring State? A helicopter in powered flight produces a downflow of air through the rotor system. This is the thrust that keeps the aircraft flying (figure 1). As a helicopter begins to descend, an upflow of air through the rotor system begins. In forward flight (above about 35 knots), the effect of rotor tip vortices is negligible.

However, as the helicopter descends and slows below 35 KIAS, the angle of the upflow increases. As descent rate increases, so does air upflow through the rotor system. When the upflow rate exceeds the downflow created by the rotor system thrust, vortices begin to form at the rotor hub and blade tips (figure 2). These vortices reduce the effectiveness of the rotor system by creating a disturbed column of air for the rotor blades to fly through. The net result of this action is a loss of lift.

Increasing collective pitch to compensate for this loss of lift only aggravates the situation by creating even larger vortices. If the condition persists, the rate of descent will increase and the aircraft will probably hit the ground with G forces in excess of those planned for. The potential for encountering vortex ring state increases with high gross weights, high density altitudes and high rates of descent combined with slow forward airspeeds (figure 3).

Continued

What to Do? Obviously, the best method of eliminating the effects of vortex ring state is to avoid it entirely. A few simple steps will help.

● Plan your approach. During the site evaluation (or chart study, in the case of tactical approaches), take time to select a final approach course that permits you to fly, as much as possible, a normal approach glide path (apparent 30° angle). A normal approach allows you to keep airspeed up during early stages of the approach and permits visual contact with the LZ through most, if not all, of the landing sequence.

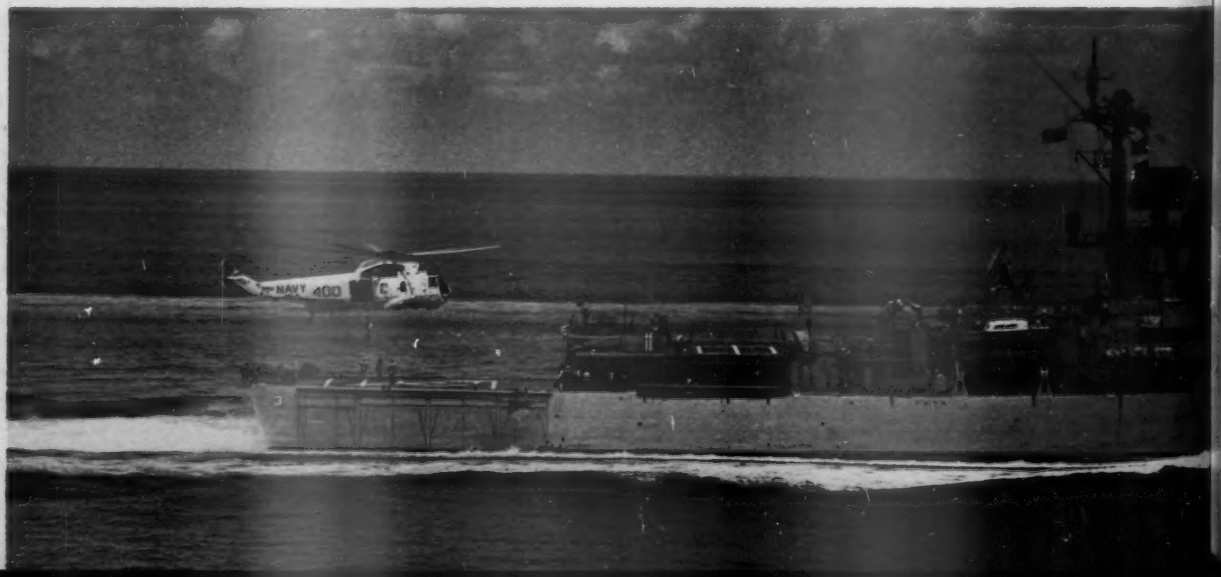
Steep approaches, on the other hand, require slower airspeeds throughout the approach and leave the helicopter more vulnerable to the effects of downdrafts. Also, in most helicopters a steep approach is synonymous with losing visual contact with the LZ on short final. If you must fly a steeper than normal approach, make it as shallow as possible and take care to closely monitor your rate of descent. Do not attempt to salvage a poor approach. It's better to go around and make another attempt.

Make sure you avoid tail wind conditions, particularly during the final portion of the approach where wind direction and velocity may change dramatically. If you maintain a head wind component throughout the approach, you diminish the possibility of premature loss of effective translational lift (ETL). An early, unplanned loss of ETL will result in a loss of altitude, an instinctive increase in collective pitch and a decrease in airspeed. These conditions favor the formation of vortex ring state.

● Control the rate of descent. By definition, vortex ring state exists when upflow exceeds downflow. Reducing the rate of descent will reduce upflow of air through the rotor system. It follows that reducing the rate of descent will necessarily inhibit the formation of rotor blade vortices. In some helicopters a rate of descent as low as 300 feet-per-minute at airspeeds below ETL may create the upflow necessary to induce vortex ring state. Under no circumstances should you allow the rate of descent to exceed 800 feet-per-minute at airspeeds below ETL and outside of ground effect. Consult your aircraft's flight manual for additional rate of descent restrictions.

● Reduce airspeed gradually during the approach. Remember, forward airspeed reduces the angle of upflow and permits rotor blades to fly through undisturbed air. Avoid decelerating below ETL airspeed until the aircraft is in ground effect, with rate of descent no more than 300 feet-per-minute, and in a position where a safe landing is assured. This becomes difficult when you must fly a steep approach. In this case, riding the "burble" of translational lift down the glide path may be a good technique.

● Ensure that power (collective pitch) required to hover does not exceed power available based on LZ terrain



restrictions. Make sure you take into account the additional power necessary to arrest the inertia of the descending helicopter. During the initial portions of the approach, keep collective setting changes to a minimum. The same control and performance techniques used during instrument flight can help here. As you continue the approach, carefully increase collective to slow your rate of descent. Excessively high collective settings produce significant downflow.

● Reducing gross weight reduces collective power demand, which subsequently reduces downflow. Some aircraft let you jettison fuel and tip tanks, which allows the air crew to adjust gross weight in flight if necessary. Thorough preflight planning can also ensure excess fuel isn't on board. Other ways of adjusting gross weight include reducing crew and equipment complements.

● You must have effective crew coordination in order to recognize symptoms of vortex ring state. With few exceptions, we don't operate single pilot. Aircraft commanders who use their crews wisely will make their own jobs a lot easier. Let the copilot monitor the gauges while the HAC focuses his attention outside. The copilot should keep the crew informed regarding rates of descent, power settings and airspeeds. It's also critical that he inform the HAC of any deviations from the planned course of action. This sounds painfully obvious, but all too often minor deviations from prebriefed descent angles turn into major problems at the bottom of the approach. There's no harm done by telling the HAC that the approach angle looks steep.

You crew members in the back also play a major part in the crew coordination process. If inexperienced, don't let this inhibit your inputs. From your vantage point in back you very possibly have the best perception of wind direction and speed on-site, not to mention excellent visibility of objects on the approach route. Keep intercom comments brief and pertinent, but if you detect a deviation, let the HAC know! One of the most disturbing comments the pilot can hear after a close call with vortex ring state comes from the crew member in the back who "thought the HAC was aware of a slight tail wind condition."

● Maintain your wave-off option. This is not unique to vortex ring state conditions; it applies when flying any approach. Once you lose this option, you're committed to land — one way or the other.

OK, So I Screwed Up and Found Myself in Vortex Ring State — What Now? In the words of a wise old aviator, "If you don't do something quick, you're gonna die!" In order to avoid this, we recommend:

● Enter autorotation. Entering autorotation automatically eliminates the downflow necessary to sustain vortex ring state. This option presupposes sufficient altitude and airspeed to recover. Given the low altitudes and airspeeds normally associated with this phenomenon, autorotation may not be possible.

● Increase forward airspeed. The increase permits the helicopter to fly out of the disturbed column of air in which it is settling. This action also requires sufficient altitude in order to compensate for the altitude loss encountered when you lower the nose to gain airspeed, although it requires less altitude than autorotation.

● Reduce collective pitch. Like autorotation, reducing collective pitch reduces downflow through the rotor system. If altitude and airspeed preclude autorotation, this option may be best. Minor reductions in collective pitch may reduce vortices but probably won't eliminate them.

Keep in mind that all of the above options require an altitude/airspeed trade off. ●

Capt. Iltis is associate editor of the MAC Flyer, Scott AFB, Ill.

Reprinted from the MAC Flyer

A Whole Day Ruined

By LCdr. Bob Miller

ONE of the jobs of the aircraft analysts here at the Naval Safety Center is to review articles submitted to Approach to help the editor ensure accuracy of the material. When the article "Helicopter-Aero Vortex Ring State," hit my desk, I thought, "Oh no, another boring technical article to struggle through." But I forced myself to read it (after all, it's part of the job) and found it an excellent explanation of one of those many mysteries of helicopter flight. When you read about the following mishap, you'll recognize the need to understand vortex ring state a lot better!

Recently, a flight of three H-3s was scheduled for a cross-country through the mountains. The brief of the flight leader included a discussion of the effects of high temperature and density altitude on takeoffs and landings. The first warning flag went up soon after the brief: The HAC of Dash Three mentioned to the flight leader that he'd called a friend along the route of flight and wanted to fly by his friend's house on the second leg of the flight. "Don't do anything that will get us any calls," the flight leader replied.

The first leg of the flight was uneventful. Inadvertently, Dash Three refueled to 3,700 pounds instead of the planned 3,500 pounds. No problem — the HAC recomputed torque available, HIGE and HOGE for NAS High Desert. Flag No. 2.

The flight climbed along the route of flight toward their next stop. Eventually, Dash Three radioed lead that he was breaking off for his previously discussed deviation. Dash two followed remaining at altitude, while Dash Three descended to 300 feet AGL.

The friend's residence was sighted, and the HAC in Dash Three commenced a gentle (10 to 15 degree angle of bank) 360-degree turn around the home. All eyes were outside, so no one noticed the aircraft was losing airspeed in the turn. On rollout, the HAC passed control back to the copilot. The copilot noticed Nr decaying below 98 percent and called "Full power, we're descending."

He applied full up collective and maintained the pitch slightly nose up, which continued to slow the aircraft down. The HAC assumed control of the aircraft, but made no control changes. They were now in the *vortex ring state* — settling with power, with the wrong control inputs in and nowhere to go but down through power lines to an unplanned gear up landing.

The aircraft impacted the rocky terrain with 1 to 2 knots groundspeed. The tail wheel hit a large rock and was sheared off. After a few bounces, it ended up in a stable 2-to 3-foot hover.

At this point they'd probably incurred less than Class C damage, and the portion of the mishap that applies to the accompanying article had occurred. Regretfully, this was only the third warning flag . . . there was more to come.

When the aircraft was stable, the crew chief called "dump fuel" and assisted in throwing the appropriate switches. Unknown to the crew, the fuel dump circuit breaker was out and no fuel was dumped. Determining that a safe landing could not be made in the area they now occupied, the HAC called for manual throttles. The copilot applied the No. 1 manual throttle; the engine temperature (T5) was 1 to 2 needle widths above red line. He then visually matched the No. 2 lever to the No. 1 lever position without noticing T5. With the added power, the aircraft began to rise, and they were able to leave the site. After reaching 250 feet AGL, the HAC passed control back to the copilot and secured the manual throttles. Neither pilot noted any T5 values during the minute or two that the manual throttles were on.

Meanwhile, the flight lead had returned to regroup his flight. An inspection by Dash Two revealed Dash Three was minus his tail wheel, forward anticollision light and ARA 25 antenna. The lower UHF antenna was dangling by a wire. The decision was made to land at a civil airport eight to 10 minutes away.

Three minutes later the adrenalin was flowing again. The copilot of Dash Three noticed the master caution light and the main transmission oil hot light illuminate. The main gear box temperature was pegged at 150 degrees. The HAC took control and radioed his intent to land immediately. During the descent torque fluctuations, yaw kicks and rumbling noises were accompanied by a call from Dash Two that a 5-foot flame was shooting out of the No. 2 engine exhaust.

A 'no hover' landing was accomplished with 3 to 4 knots of forward groundspeed. The aircraft pitched forward, rocked back and then rolled left as the port sponson collapsed. The crew egressed safely. Class B damage had been incurred.

The mishap board in this squadron did an excellent job gathering the facts so we could all profit from the hard-learned lessons of their squadron mates. No punches were pulled. The fortitude to tell it like it was, which is so vital to the success of the Navy's safety program was certainly evident.

The bottom line? Vortex Ring State can and does occur. Read the technical article. Read your NATOPS manual. Understand what "settling with power" is, how to avoid it and what to do to get out of it **before you experience it!**

LCdr. Miller is the H-3 analyst at the Naval Safety Center, Norfolk, Va. Previously he flew SAR flights out of NAS Oceana, Va. He has logged 1,800 hours in helos, including time in Vietnam off USS *Enterprise* (CVN 65).

All In a Night's Work

By Lt. G.S. Whitehead

NIGHT carrier ops — no moon illumination, glassy sea state, intermittent doppler and the plane guard pattern. The stage was set. These are not an SH-3H pilot's "favorite" conditions to dip. You would think a pilot would give these conditions their proper respect, but not these two helo pilots on this night. They gave into perceived mission considerations to maintain their currency of six night doppler approaches to a hover per month. They waved off their first two approaches due to the doppler not acquiring, but that did not stop the young warriors from completing their mission. "Standby alternate," the aircraft commander announced.

These two pilots were going to beat the odds. After all, they say, the third time's the charm.

"Coupler," the HAC called as he removed his feet from the pedals. "Coupler engaged, three lights, alternate," the copilot replied as he began his instrument scan. The collective lowered, and the descent from 150 feet began for the start of what would be the longest three minutes of either of the young pilots' careers.

The helo followed what seemed to be the normal approach parameters, hitting gates at 80 feet and 30 knots. The cockpit lit up. The doppler had gone into memory due to the glassy sea state.

"You have a memory light probably due to the low sea state," the copilot said.

"Roger, we'll just go ahead and continue down until the doppler acquires in the rotor wash. Just back me up."

They reached 40 feet with no problems, and all the pilot had to do was "beep" the nose up to slow the aircraft down so the rotor wash could catch up with the helo. The nose was "beeped" up until it was uncomfortable for both pilots, but still no acquisition of the doppler. There were no cockpit indications of groundspeed or drift (due to lack of doppler) and no visual references (due to lack of horizon), but did the pilots wave off the approach and call it a night? Not these two, they were determined.

"I'm going to turn on the spotlight to see if the rotor wash is coming in."

Now let's stop and examine the situation. We have two pilots in a helicopter at 40 feet. They have no indication of aircraft groundspeed, and they don't know if the aircraft has any drift. They are "beeping" the nose up, and now they are going to turn on the aircraft's vertigo-inducing spotlight.

The spotlight came on, and the aircraft commander gazed out of his window and proclaimed, "I can't see the water, let alone the rotor wash." The spotlight went off. The pilot returned his scan inside the cockpit when the nose began to pitch up, then down. There was a right yaw. The copilot remembers seeing the torque go to max. He said, "I got it." His scan went immediately to the attitude gyro, and he thought, "I got to keep the wings level." Then something made him look at the rest of his attitude instruments. Instinct, intuition, maybe just training — who knows, but once this happened the aircraft came under control. What had started at 150 feet, three miles and abeam the carrier was now climbing through 500 feet, six miles and approximately 045 degrees from the carrier.

"Is the ASE on?" the pilot-at-the-controls asked.

"Negative, ASE coming on now, now, now!" "What the hell happened? Where's the carrier?" "God, we're at 045 at six." "How'd we get out here?" "I don't know, but are you OK?"

"I'm OK. Crew, are you OK?"

Incidentally, this flight not only had two pilots but two aircrewmen and special crewman.

Let's review. A helo, with a crew of five, is covering the plane guard duties for a night recovery. It is doing dips three miles from the carrier, on what most helicopter pilots would consider the worst conditions. Nothing new. It happens all the time. But what did happen doesn't occur all the time. The two pilots didn't take the environmental warnings into consideration and continued to try to get out a qual that could have waited for another night. You call it aggressiveness. Maybe on the first or second dip, but as these two found out, the third time is not the charm. They got so wrapped up in getting the qual that they completely forgot safety of the crew. When the incident occurred the helo spiraled straight up 600 feet, went through at least 540 degrees of turn, and traveled from three to six miles. Call it luck, but what would have happened if the aircraft would have traveled three miles in the opposite direction?

Lt. Whitehead flies SH-3Hs with HS-2, NAS North Island, Calif.

GCAS . . . And What It Can Do For You

By Cdr. Mike Morgan

By warning the pilot of a CFIT situation, GCAS can be a real life-saver.

THE following are five hypothetical examples of the A-7E's Ground Collision Avoidance System (GCAS) in operation. Although none of the examples are meant to present any particular mishap, they do illustrate typical cause factors and how a functioning GCAS system can help to break the mishap chain.

Case No. 1. Following his first night catapult launch in 13 days, the first-tour lieutenant noticed that his radar altimeter had failed. After establishing and checking his initial climb, he cycled the radar altimeter knob through the off position and then reset the bug, hoping that this would regain the system. It did not. At about this time, he made a visual check outside the cockpit and spotted aircraft lights at his 12 o'clock position, slightly high. Following a quick scan of his instruments, he again looked at the lights and perceived a closure rate on what he thought to be a single aircraft. He remembers checking his airspeed at this point and then shifting his scan back to the lights, which were slowly diverging in his windscreen.

Suddenly, his perceived rate of closure increased dramatically. The pilot initially made a slight downward adjustment in nose attitude, which seemed to have no effect. Following that, his attention was devoted almost entirely to avoiding the apparent imminent midair, and he can remember no specific flight control inputs. During his evasive maneuvers the GCAS aural warning tone came on concurrently with the flashing-X display on the aircraft's HUD. The pilot checked his instruments and noticed a nose down, slightly left wing down attitude on his ADI. He then performed a normal recovery, observing the pressure altimeter bottoming out slightly below 300 feet. Postflight reconstruction revealed that the lights were an F-14 separating from the tanker two to three miles ahead of the ship after tanking just below the 1,800 foot overcast.

Case No. 2. The squadron operations officer was slightly late pushing out of the No. 2 spot in the marshal stack for a night Case III approach. He remembers feeling a bit rushed and behind the aircraft at platform, due to a constantly changing final bearing and the failure of the ACLS system to self-test properly. At platform the LAWS tone came on ("bug" setting of 4,900 feet), and after punching off the tone, he adjusted his speed brake position and nose attitude while switching to his final approach frequency. The pilot's normal habit pattern was to reset his radar altimeter warning bug as he was checking in with final; tonight, however, he experienced very broken and garbled reception on his assigned channel. As he entered the tops of the low stratus layer at about 4,000 feet he still was unsure of final bearing. He was not in radio contact with the ship and was attempting to check all frequency and switch positions to complete his ACLS checks. After descending out of the bottom of the cloud layer at 2,000 feet, he looked ahead and to his left to visually acquire the ship and to get a rough gouge on the final bearing. Shortly thereafter, the GCAS aural

warning tone came on; the pilot immediately applied back pressure to mild buffet and resumed his instrument scan. A normal recovery was effected, with a minimum altitude of 400 to 500 feet observed on the radar altimeter. The pilot could not state what his nose attitude or rate of descent was at the time that recovery was initiated.

Case No. 3. The pilot, a newly qualified section leader, was assigned to the XO's wing for this day section tactics flight. The flight progressed normally until the fourth run, which was briefed for a low altitude run-in in combat spread followed by a coordinated section veer attack on the target. As the pilot commenced his pop and roll maneuver, he realized that he was both too close to the target laterally and very short on interval. He reduced power, pulled his nose up, and removed most of his bank angle in an attempt to float out and increase his interval on the flight lead. Three to four seconds later, the pilot commenced rolling and pulling the nose of the aircraft towards the target for his own delivery run. He said that it took "just about a max turn" to get the nose over and down towards the target, with the automatic maneuvering flaps deploying at some point in this maneuver.

The pilot considered aborting the turn, but the reduced buffet and increased pitch rate sensed with the flap deployment convinced him that he would be able to make it. The GCAS aural warning tone and HUD pullup commands occurred shortly after the pilot started his rollout from a nose low and almost inverted position, at which time he rapidly rolled wings level and recovered to level flight at some unknown low altitude.

Case No. 4. The CAT II FRS replacement pilot (RP) was halfway through a day system low-level navigation flight in the western U.S. Crossing a wide valley on an easterly heading towards the next line of mountains, the RP decided to do some computer reentries and "general cockpit housecleaning" in this comparatively low-tempo portion of the mission. He climbed to 500 feet on the radar altimeter and engaged the altitude and heading hold modes of his AFCS, then commenced entering the next series of way points into his computer while occassionally scanning outside of the cockpit for traffic or other conflicts.

The pilot remembers feeling very relaxed, confident and ahead of the situation at this point in the flight. After completing his entries he checked through them and found one error, which he then began to correct. While doing this his computer in-panel began to flash a "heads-up" message in the display. He immediately checked his HUD FPM and the terrain forward of the aircraft and saw nothing apparently wrong. Checking the radar altimeter,

GCAS will provide only a limited range of anticipatory warnings and is oriented, as much as possible, towards not interfering in the cockpit environment unless and until a pullup becomes necessary to avoid ground collision.

he noticed it decreasing through about 110 feet with the aircraft still in level flight. Postflight analysis by the squadron safety officer showed that the lack of surface detail and early morning shadows had obscured the rising terrain into which the aircraft was flying. In addition, the pilot had neglected to reset his radar altimeter warning bug from its takeoff setting of 50 feet.

Case No. 5. The pilot was No. 2 in a three-plane flight entering the Case I break pattern aboard a CV. Actual weather at the time was marginal Case II, with frequent rain showers reducing visibility and obscuring the horizon. Following the leader's break, No. 2 concentrated on his timing and on maintaining altitude and heading. Breaking on time, the pilot extended his speed brake and established a level decelerating turn. With his TACAN inoperative, the pilot estimated that he was three to four miles ahead of the ship at the time that he broke.

With his turn established, No. 2 looked outside to check his interval. Failing to see the lead immediately, he looked back toward the ship and found that he could just barely see it in the light showers. He remembers checking airspeed before looking again for the lead, whom he still could not acquire. Becoming concerned about interval at this time, he momentarily rolled out and checked for traffic to the outside of the turn. Seeing nothing, and now concerned for his own pattern, he reestablished his bank angle and "pulled hard" while once again looking for his interval, who he still could not see. To make matters worse, he now discovered that the ship had disappeared behind a rain shower. Shortly thereafter, the pilot was startled by the GCAS aural warning tone. He checked his HUD display, saw the flashing-X command, and executed an immediate recovery to a wings-level pullup. The minimum altitude reached was slightly below the radar altimeter bug setting of 375 feet as shown by the LAWS tone activation.

CFIT The Number of the Beast

The common thread of the five scenarios just presented is the close avoidance of what has come to be known as CFIT, for Controlled Flight Into Terrain. CFIT defines a mishap generally characterized as follows:

- The aircraft unintentionally impacts the surface.
- At the time of impact, the pilot was not physically incapacitated.
- At the time of impact, the aircraft was not in a stalled condition and was mechanically and structurally intact.

Obviously, these type mishaps can be caused by a wide variety of factors: distraction, disorientation, complacency, unauthorized maneuvers, loss of situational awareness and so forth. Regardless of the underlying causes of the mishap, CFIT is invariably the cause of the damage and injury.

The following illustrates the severity of the CFIT problem in the TACAIR community. Table 1 lists all CFIT-related mishaps for TACAIR assets from 1968 to 1985.

Table 1

Type Aircraft	Total CFIT Mishaps	Total Fatalities
A-7 (A/B/C/E/TA-)	52	50
A-6 (A-E,KA-6,EA-6)	28	51
A-4 (A-F)	28	28
A-4M	8	8
F-4 (B-S)	30	58
F-14	6	10
F-18	2	2
Totals	154 Aircraft Lost	207 Air crew

The mishaps listed in Table 1 are those that were either definitely or most probably CFIT-related. Obviously, in some of the probable cases, it's impossible to state with certainty that it was, in fact, a CFIT mishap; other factors may well have intruded that, due to the nature of the mishap, remain unknown. Even granting that the totals may be in error in one direction or the other, the overall scope of the losses remains staggering. Although no detailed analysis was done for the 1986 period, a scan through the Weekly Summaries indicates that the historical trend is continuing.

What a GCAS System Is

GCAS is a new term for the light attack aviator. The purpose of GCAS, put most simply, is to predict an impending CFIT situation and to effectively prevent it by issuing timely and distinctive warnings.

The more commonly accepted name from this type of system is GPWS, for Ground Proximity Warning System. Commercially developed GPWS systems are today a common feature among the heavies of the world's airlines and, indeed, have already been fielded in several of the Navy's larger type airframes (with one GPWS "save" already credited in the C-9 community).

The use of GCAS instead of GPWS to define the system being developed for the A-7E aircraft has its roots in the original joint developmental effort on this sytem that was undertaken with the USAF/ANG Fighter Weapons Office at Tucson. The unique name has been maintained to emphasize the differences between the A-7 GCAS and the "typical" commercial GPWS systems, some of which have been modified for use in tactical aircraft on a test basis.

There are several essential differences between the two systems. A typical GPWS system is characterized by the installation of some sort of a specialized black box in

the aircraft. This separate box contains the microprocessor(s) and all the hardware and software required for ground avoidance calculations, control functions, generation and presentation of warnings, and so forth. In most cases, this would include voice synthesis for verbal warnings. This central box is then interfaced with various aircraft systems in order to input the data required for the system to work, such as current aircraft altitude, attitude, performance and configuration. Specialized controls and indicators are added to the cockpit environment including, typically, provisions for the air crew to indicate to the GPWS system the current operating mode or environment of the aircraft (which will influence the types of warnings provided).

In contrast, the A-7 GCAS system is entirely software-based. It will reside in the aircraft's TC-2A mission computer as part of its Operational Flight Program (OFP). No new hardware will be added to the aircraft: GCAS will use the existing systems and sensors provided in the aircraft's Navigation and Weapons Delivery System, although they will be used in different ways and in significantly expanded operating envelopes. An absolute minimum of pilot interaction will be required for GCAS; it is essentially an "always on" system and will be capable of providing warnings throughout most of a typical mission profile, from launch to the final stages of a landing approach.

Another difference is illustrated by the names themselves. A ground proximity warning system typically provides a broad band of visual and aural warnings as the aircraft gradually becomes closer to the terrain. In most cases, it provides automatic warnings if the aircraft is below some selectable minimum altitude and, in general, its design is oriented around instrument approaches. GCAS, in contrast, will provide only a limited range of anticipatory warnings and is oriented, as much as possible, towards not interfering in the cockpit environment unless and until a pullup becomes necessary to avoid ground collision.

Finally, and perhaps most importantly, GCAS will assume by default the deployed, CV-operating environment. It will be designed to provide the most automatic and effective warnings in the mission areas that have traditionally and statistically been the most hazardous for the light attack aviator.

Continued

Development and Current Status of A-7 GCAS

GCAS has been under development at the Naval Weapons Center since March of 1985.

Initial efforts were limited to the development and test of methods to more accurately predict the aerodynamic performance of the aircraft and to expand the accepted operating envelope for the A-7's installed radar altimeter. Shortly thereafter, performance specifications were developed, and comprehensive system design efforts began. These were undertaken primarily by personnel in the A-7 Weapons System Support Activity (WSSA), with support from various matrixed organizations within the Center's Aircraft Weapons Integration Department.

Sufficient progress was made by early 1986 to develop and submit an engineering change proposal for formal incorporation of GCAS into the A-7 naval weapons delivery system (NWDS). This was done, and in addition, the GCAS moding was submitted to the Software Change Review Board (SCRB) for the replacement of ground avoidance with GCAS in the aircraft's operational flight program (OFP). Since that time, approval has been received and funding sources identified, allowing the WSSA to proceed with the project. GCAS has been slated for incorporation into A-7 OFP/NWC, now in active development at the Naval Weapons Center. NWC-6 will be delivered to VX-5 for FOT&E in early 1988, with Fleet delivery occurring later that year.

Although this article has addressed GCAS as it will be installed in the A-7E aircraft, the fundamental system design can be easily adapted to other tactical aircraft equipped with equivalent systems and sensors. The basic processes and program logic would remain essentially as is, with changes required only in those areas having installed displays and controls.

Neither GCAS nor any other system using today's fielded technologies will be capable of providing effective warnings 100 percent of the time. Of 34 A-7E mishaps during 1968 through 1985, GCAS would have been capable of providing warnings in 32 of them. Only 11 of the 34 would have been covered by the currently deployed and optimized ground avoidance routines, which are themselves much more advanced and effective than those that were available in the OFP as little as two years ago.

Any installed GCAS system, in order to be effective, must earn the respect of its air crew users. It will do so by accurately and effectively providing warnings and guidance at the appropriate times and places. By the same token, air crew confidence (and response) would be severely eroded by the issuance of excessive false or inappropriate warnings. The system design will, therefore, try to minimize these false warnings as much as possible. Unfortunately, this effort will mean that warnings must be specifically inhibited in certain flight conditions (low altitude maneuvering flight over rough or mountainous terrain would be one example).

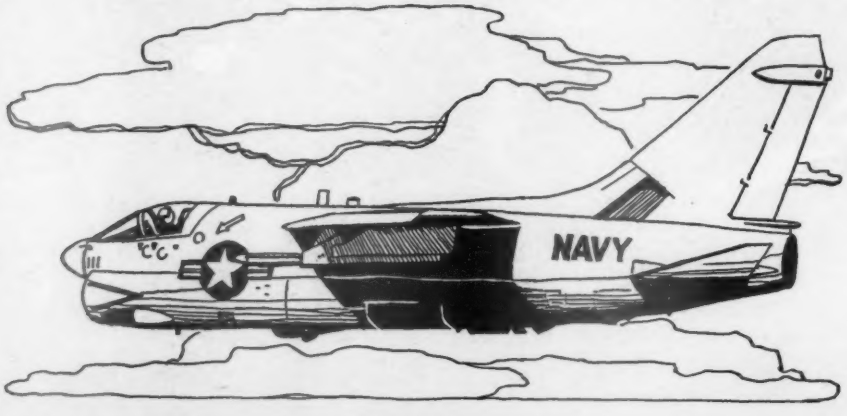
A series of design tradeoffs are required. In A-7 GCAS, these will be made to provide as close to 100 percent coverage for overwater flight conditions as is possible, with correspondingly less coverage being provided as the terrain features become more complex and demanding or as the available sensors become less effective. One way of viewing this approach is to state that GCAS will provide the most effective warnings in those flight conditions in which the average pilot might be paying the least attention to this terrain clearance. The end result of these tradeoffs is summarized in these two statements:

"GCAS won't provide a warning each and every time that one is required."

"If GCAS does provide a warning, it should be taken as valid." GCAS is not a panacea. As no direct link to the flight controls is provided, the system will not actively intervene to prevent any CFIT mishap. Rather, its function is to serve as an autonomous backup for the pilot, alerting him to a specified range of hazardous flight conditions and allowing him sufficient time to affect a safe recovery.

Finally, GCAS is not intended as a substitute for proper pilot training or flight discipline and procedures. These are and will continue to be the single most important and effective means in the prevention of these and all other mishaps. ●

Cdr. Morgan is the Deputy Program Manager, A-7E Weapons System Support Activity, NWC, China Lake. He previously served in VA 25, VA 37 and VA 174.

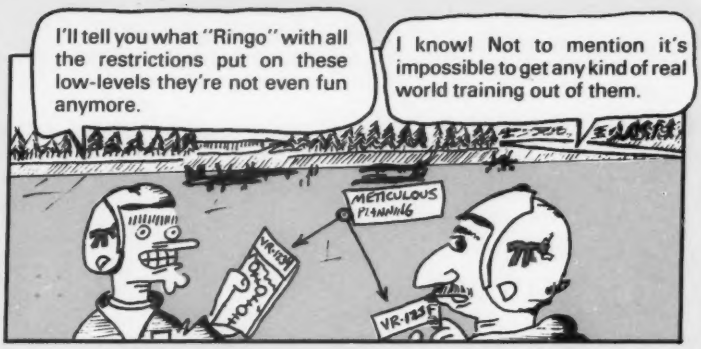


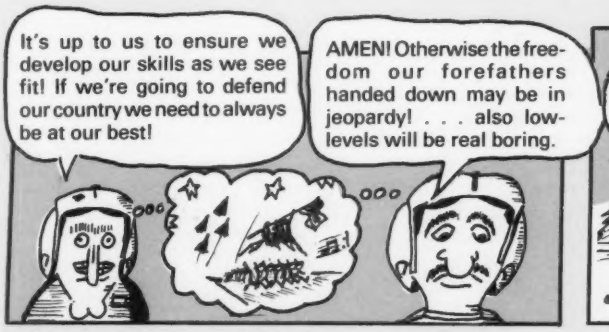
Stork with help from flea presents:

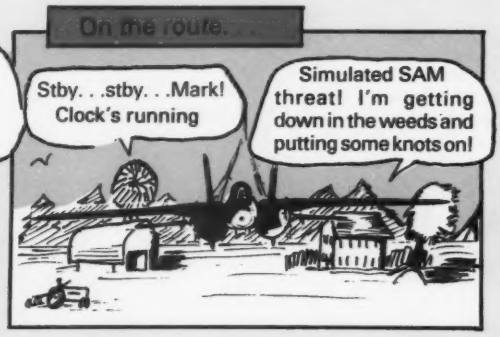
BROWNSHOES IN ACTION COMIX

"The kind real aviators like"

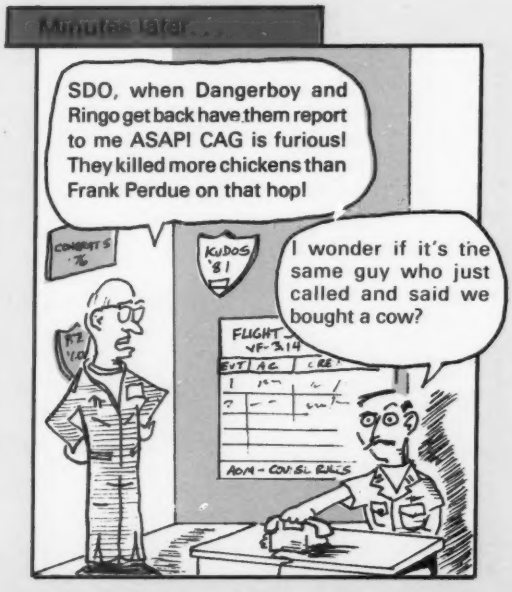
Contributed by Lt. Ward Carroll, VF 32


I'll tell you what "Ringo" with all the restrictions put on these low-levels they're not even fun anymore.
I know! Not to mention it's impossible to get any kind of real world training out of them.
METICULOUS PLANNING
VR-123F


It's up to us to ensure we develop our skills as we see fit! If we're going to defend our country we need to always be at our best!
AMEN! Otherwise the freedom our forefathers handed down may be in jeopardy! . . . also low-levels will be real boring.



Hey, those people are waving to us!
The American farmer is the biggest patriot known to this country! They love us! I'll tap burner for 'em.


Minutes later. . .
SDO, when Dangerboy and Ringo get back have them report to me ASAP! CAG is furious! They killed more chickens than Frank Perdue on that hop!
I wonder if it's the same guy who just called and said we bought a cow?
KUDOS '81
FLIGHT VF-3.14

Detroit Public Library
Technology & Science Dept.

When it comes to low passes, the best you can do is tie the record.